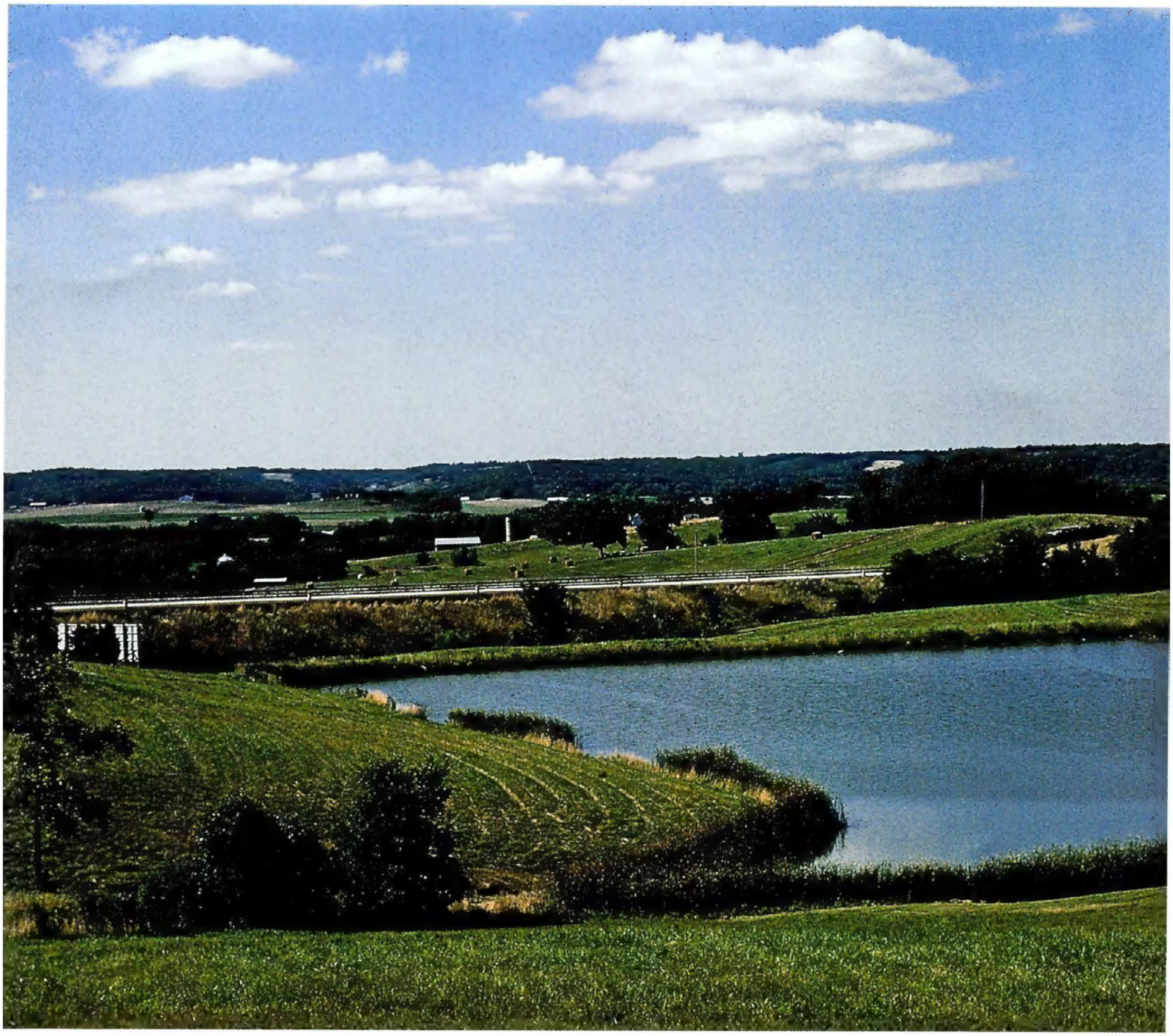
USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Missouri Department of Natural Resources and Missouri Agricultural Experiment Station

Soil Survey of Cooper County, Missouri



How To Use This Soil Survey

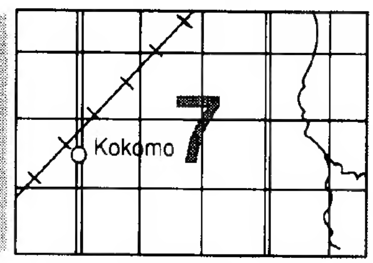
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

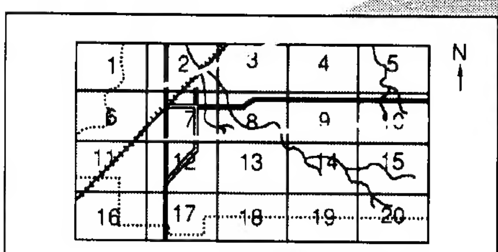
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



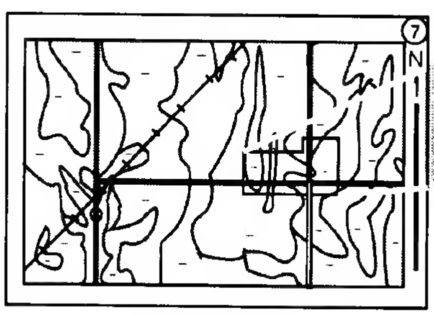
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

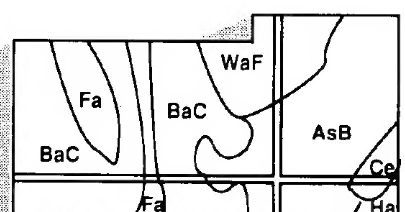


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period from 1988 to 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service, the Missouri Department of Natural Resources, and the Missouri Agricultural Experiment Station. It is part of the technical assistance furnished to the Cooper County Soil and Water Conservation District. The Missouri Department of Natural Resources provided soil scientists to assist with the field mapping. Additional funding was provided by the Cooper County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: A pasture of cool-season grasses in an area of Bluelick silt loam, 15 to 25 percent slopes, eroded. The Goss-Wrengart-Bluelick association is in the background.

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Issued 1998

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Cooper County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Cooper County, Missouri

By John L. Baker, Natural Resources Conservation Service

Fieldwork by John L. Baker, David M. Skaer, Keith O. Davis, and Stewart F. Miller, Natural Resources Conservation Service; Gregory D. Caldwell and Richard L. Henderson, Missouri Department of Natural Resources; and James H. Lee, Cooper County Soil and Water Conservation District

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
the Missouri Department of Natural Resources and the Missouri Agricultural Experiment Station

COOPER COUNTY is in central Missouri (fig. 1). It is bordered by the Missouri River on the north. The total area of the county is 364,205 acres, or about 569 square miles. Boonville, the county seat, is located in the north-central part of the county. In 1990, Boonville had a population of 8,393 and the county had a population of 14,835 (Missouri Crop and Livestock Reporting Service, 1992).

The northern part of Cooper County is in the Central Mississippi Valley Wooded Slopes major land resource area. The southern part is in the Ozark Border major land resource area of the East and Central General Farming and Forest Region of the United States (Austin, 1981).

Farming is the main enterprise in the county. Soybeans, corn, and wheat are the major crops, and beef cattle and hogs are the principal livestock. The flood plain along the Missouri River and the less sloping areas in the uplands are used for cultivated crops. The steeper areas are used mostly for pasture, hay, woodland, or orchards.

Commerce and industries are a growing source of income in the county. Industries include small appliances, mobile homes, fiberboard, and feed and seed. Interstate Highway 70, the Missouri River, and the railway system provide transportation to the county.

This survey updates the soil survey of Cooper County published in 1911 (Sweet, 1911). It provides additional information and has larger maps, which show the soils in greater detail.

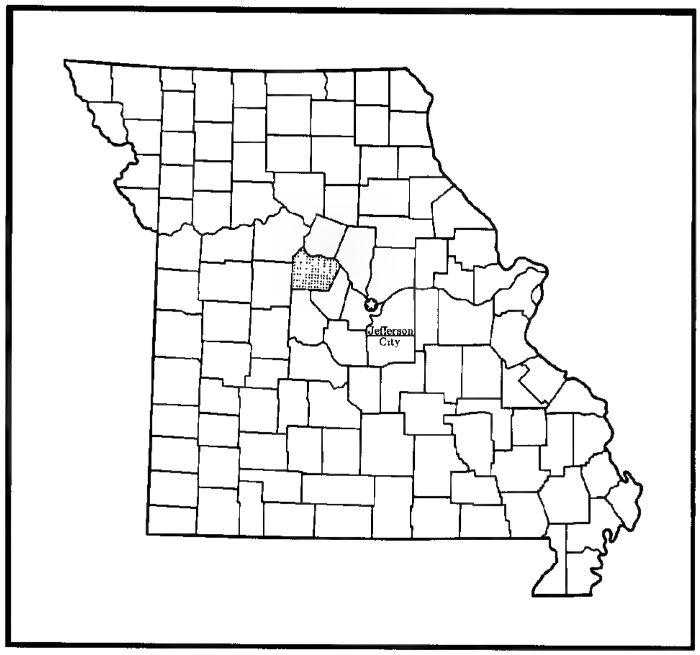

Figure 1.—Location of Cooper County in Missouri.

General Nature of the County

This section provides general information about the county. It describes the climate and history of the county and physiography, relief, and drainage.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at New Franklin in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 30 degrees F and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred on December 23, 1989, is -22 degrees. In summer, the average temperature is 76 degrees and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 31, 1980, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 37.45 inches. Of this, about 24 inches, or 64 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 5.5 inches on August 27, 1982. Thunderstorms occur on about 52 days each year, and most occur in May and June.

The average seasonal snowfall is about 11 inches. The greatest snow depth at any one time during the period of record was 15 inches, and the heaviest 1-day snowfall on record was 13 inches. On the average, 8 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 66 percent of the time possible in summer and 49 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 12 miles per hour, in March.

History

Cooper County was part of the Louisiana Purchase of 1803. The first settlement was in the northern part of the county, where Boonville stands today. This settlement was established about 1810 (Missouri Crop and Livestock Reporting Service, 1992).

The early settlers came from Kentucky, Tennessee, and Virginia. They settled in timbered areas and in areas of bottom land along the rivers. They hunted, fished, and cleared small patches of woodland for planting corn and vegetables. The early settlers believed that the prairie soils were not as productive as the soils in areas of woodland and on bottom land. About 1830, however, a few settlers tried growing crops on the prairie. They were so successful that settlement began to spread into the prairie areas (Sweet, 1911).

Cooper County was established in 1818. It was named after the Cooper family, who were early settlers. The original area included Saline, Pettis, and Moniteau Counties. The present boundaries of Cooper County were established by the Legislature in 1845.

The first census of the county was taken in 1820 and reported a population of 6,959 (Weinholt, 1990). The population had increased to 22,532 by 1900, but it was only 14,835 in 1990. Except for Boonville Township, the population had decreased in all areas of the county by 1990 (Missouri Crop and Livestock Reporting Service, 1992).

The number of farms in Cooper County decreased from 2,664 farms in 1900, averaging 127 acres, to 929 farms in 1987, averaging 334 acres (Missouri Crop and Livestock Reporting Service, 1992).

Agriculture has always been the most important industry in Cooper County. The production of row crops, mainly corn and soybeans, accounts for almost half of the total farm income of the county. More than 125,000 acres is used for the production of crops. In 1989, Cooper County was ranked 9th in wheat production in the state. About 2,190,000 bushels of wheat was produced in that year. The acreage used for wheat was about 38,800 acres (Missouri Crop and Livestock Reporting Service, 1990). Major improvements in management practices, fertilizer quality, and seed quality have increased the average yield from 13.5 bushels per acre in 1909 to 56.4 bushels in 1989. The production of soybeans for seed started in the late 1920's and steadily increased until 1980. In 1989, the acreage used for soybeans was 45,400 and that used for corn was 39,700 (Missouri Crop and Livestock Reporting Service, 1990). Grain sorghum is a minor crop in the county. The acreage used for grain sorghum fluctuates, depending on market value and weather

conditions. In 1989, about 4,000 acres was used for grain sorghum (Missouri Crop and Livestock Reporting Service, 1990). Beef cattle, hogs, and turkeys are the major livestock and poultry raised in the county.

The Cooper County Soil and Water Conservation District was organized in 1974. It was the 103rd soil and water conservation district established in Missouri.

Physiography, Relief, and Drainage

Several physiographic areas are in Cooper County. The Missouri River flood plain, in the northern and northeastern parts of the county, ranges in width from a few feet on the Cooper County side to about 2 miles at its widest point. The flood plain is level, nearly level, or very gently sloping. Silty and sandy soils generally are closer to the river channel, and the more clayey soils are farther from the channel. Some of the old channels are low and wet and can be farmed only during periods of low rainfall.

The rest of the county consists of very gently sloping to steeply sloping, dissected uplands. These uplands are Pennsylvanian, Mississippian, and Ordovician bedrock covered by varying thicknesses of loess (Missouri Geological Survey, 1979). The loess is thickest in the highly dissected hills close to the Missouri River. It gradually thins to the south, where the summits are covered with loess and where material weathered from limestone and sandstone is on the back slopes. Elevation ranges from 570 feet above sea level in an area on the Missouri River in the northeast corner to about 940 feet on the highest ridges in the uplands in the southern part of the county.

The drainage in the western part of the county generally is from south to north. This part of the county drains into the Blackwater and Lamine Rivers (fig. 2). The main tributaries are Otter, Honey, Clear, Skull, Heath, and Chouteau Creeks. The central and southern parts of the county are drained by Petite Saline and Moniteau Creeks. The main tributaries of Petite Saline Creek are Stephans Branch, Clarks Fork, and Wolf Creeks. Pisgah and Smiley Creeks are the main tributaries of Moniteau Creek. All of the drainage from Cooper County eventually flows into the Missouri River.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and

Figure 2.—The Lamine River and its tributaries drain the western part of Cooper County.

the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils on the soil maps in this survey do not fully agree with those on the maps in the surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the

intensity of mapping, and correlation decisions that reflect local conditions. In some cases, combining small areas of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately and giving them different names.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map in this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Haynie-Waldron-Leta Association

Very deep, nearly level, moderately well drained and somewhat poorly drained soils that formed in alluvium; on flood plains

The soils in this association are on the flood plain along the Missouri River. Differences in thè soils are largely a result of the texture of the material in which they formed. In general, the loamy soils are in the highest positions on the landscape and the clayey soils are in the lowest positions. Slopes range from 0 to 2 percent. This association makes up about 3 percent of the survey area. It is about 41 percent Haynie and similar soils, 17 percent Waldron soils, 11 percent Leta soils, and 31 percent soils of minor extent and areas of water (fig. 3).

The moderately well drained Haynie soils are on natural levees. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Substratum:
9 to 60 inches, layered grayish brown, dark grayish brown, and brown, friable silt loam

The somewhat poorly drained Waldron soils are in abandoned channels. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 9 inches, very dark gray, friable silty clay loam

Substratum:
9 to 60 inches, layered dark grayish brown and very dark gray, mottled, firm silty clay loam and silt loam

The somewhat poorly drained Leta soils are on high natural levees adjacent to backswamps. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 12 inches, very dark grayish brown, firm silty clay loam

Subsurface layer:
12 to 18 inches, very dark grayish brown, firm silty clay

Subsoil:
18 to 26 inches, dark grayish brown, very firm silty clay

Substratum:
26 to 60 inches, layered grayish brown and brown, mottled, very friable silt loam

Of minor extent in this association are Buckney, Darwin, and Sarpy soils. Buckney soils are well drained and are on natural levees. Darwin soils are poorly drained and are in backswamps. Sarpy soils are excessively drained and are on splays.

Grain farming is the main enterprise in areas of this

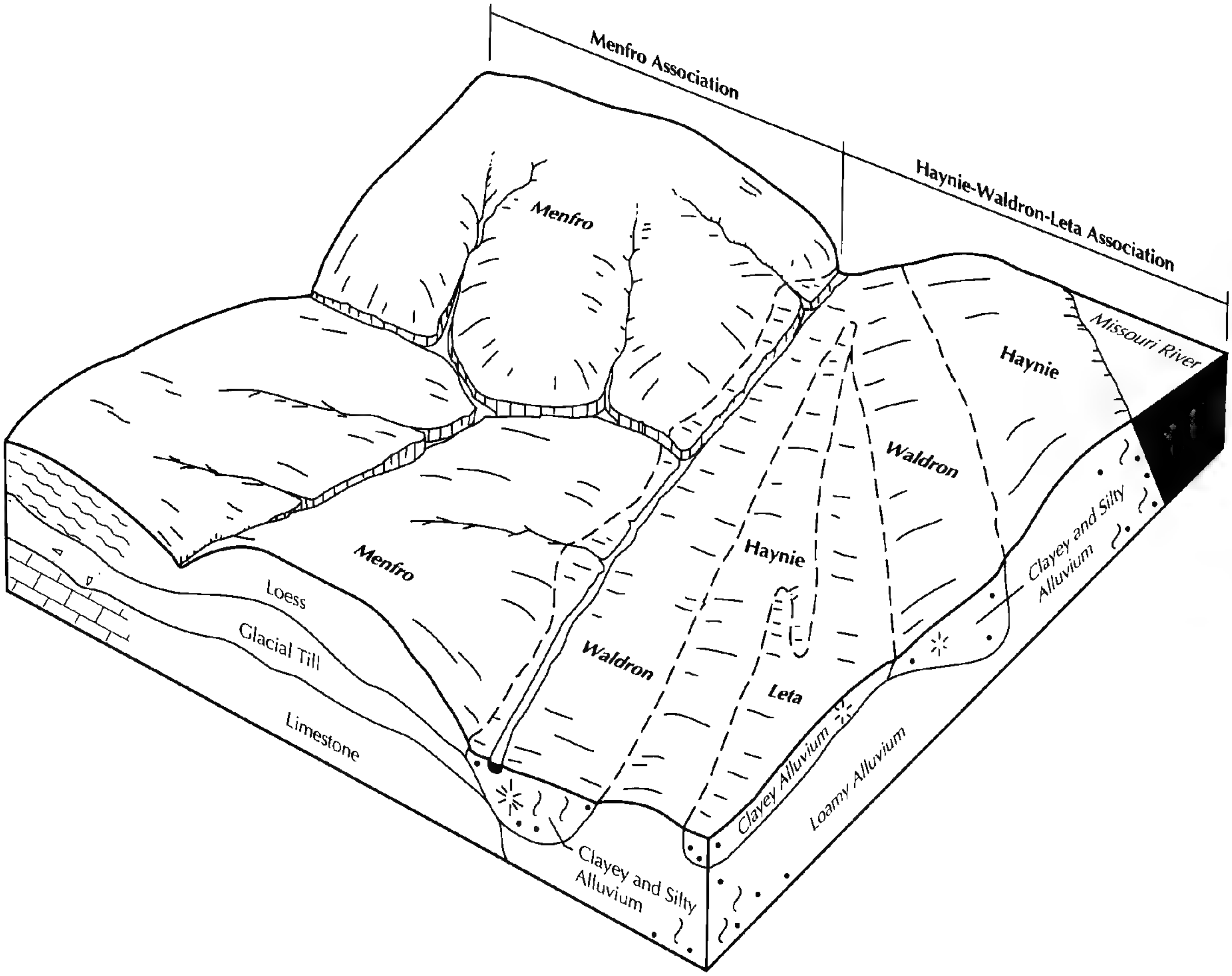

Figure 3.—Typical pattern of soils and parent material in the Haynie-Waldron-Leta association and the Menfro association.

association, but a few small areas are wooded. The main crops are soybeans, corn, and winter wheat. Flooding is the main management concern in areas of the Haynie soils. Wetness and flooding are the main concerns in areas of the Leta and Waldron soils.

These soils are suited to trees. A few areas, mainly next to the Missouri River channel on the back side of the levee, are wooded. Seedling mortality and the windthrow hazard are the main concerns affecting the planting and harvesting of trees on the Leta soils. Seedling mortality is the main concern in areas of the Waldron soils.

The soils in this association generally are not used for building site development or sanitary facilities because of wetness and flooding.

2. Menfro Association

Very deep, gently sloping to steep, well drained soils that formed in thick loess; on uplands

The soils in this association are on summits, shoulders, and back slopes dissected by many branching, V-shaped drainageways. Slopes range from 3 to 35 percent. This association makes up about 26 percent of the survey area. It is about 66 percent Menfro and similar soils and 34 percent soils of minor extent (fig. 3).

Menfro soils are on narrow summits, shoulders, and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 6 inches, brown, friable silt loam

Subsoil:
6 to 49 inches, dark yellowish brown, firm silty clay loam and silt loam

Substratum:
49 to 60 inches, yellowish brown, friable silt loam

Of minor extent in this association are Goss and Weller soils. These soils are on the lower back slopes below the Menfro soils. Goss soils are gravelly throughout. Weller soils are moderately well drained.

About 70 percent of the acreage in this association is cleared and is used as cropland or pasture. Soybeans, winter wheat, and corn are grown in the less sloping areas. Cool-season grasses and legumes are grown for pasture and hay. Measures that help to control erosion are the major management needs if row crops are grown. In steep areas used for pasture, overgrazing during wet periods results in rapid erosion.

The woodland in this association is mainly in the steeper areas. Oaks and hickories are the main species. The slope restricts the use of equipment and is a limitation affecting logging roads and skid trails.

The soils in this association can be used for building site development or sanitary facilities. The slope and the shrink-swell potential are the major management concerns.

3. Dockery-Speed-Moniteau Association

Very deep, nearly level and very gently sloping, somewhat poorly drained and poorly drained soils that formed in alluvium; on flood plains

This association is on the flood plains along the Lamine River, Petite Saline Creek, and Moniteau Creek and their tributaries. Slopes range from 0 to 2 percent. This association makes up about 9 percent of the survey area. It is about 46 percent Dockery and similar soils, 19 percent Speed and similar soils, 15 percent Moniteau and similar soils, and 20 percent soils of minor extent and areas of water (fig. 4).

Dockery soils are on low flood plains. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Substratum:
7 to 38 inches, mottled, dark brown and very dark gray, friable silt loam
38 to 60 inches, layered very dark grayish brown, dark grayish brown, and grayish brown, mottled, friable silt loam

Speed soils are on high flood plains. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 8 inches, very dark gray, friable silt loam

Subsurface layer:
8 to 14 inches, very dark gray, friable silt loam
14 to 27 inches, dark grayish brown and grayish brown, mottled, friable silt loam

Subsoil:
27 to 60 inches, dark grayish brown and grayish brown, mottled, firm silt loam

Moniteau soils are on high flood plains. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 10 inches, grayish brown, friable silt loam

Subsurface layer:
10 to 19 inches, mottled, grayish brown and light brownish gray, friable silt loam

Subsoil:
19 to 60 inches, mottled, grayish brown, gray, dark yellowish brown, and dark gray, firm silty clay loam

Of minor extent in this association are Bremer and Zook soils. These soils have more clay in the subsoil than the major soils. Bremer soils are on high flood plains. Zook soils are in backswamps.

Grain farming is the main enterprise in areas of this association. Soybeans, corn, and winter wheat are the major crops. Flooding and wetness are the major management concerns.

The soils in this association are suited to wetness-tolerant cool-season grasses and legumes. The wetness and the flooding are the main concerns affecting pasture management.

The soils in this association generally are not used for building site development or sanitary facilities because of the wetness and the flooding.

4. Arisburg Association

Very deep, very gently sloping to moderately sloping, somewhat poorly drained soils that formed in loess; on uplands

The soils in this association are on summits and back slopes on high broad divides between major

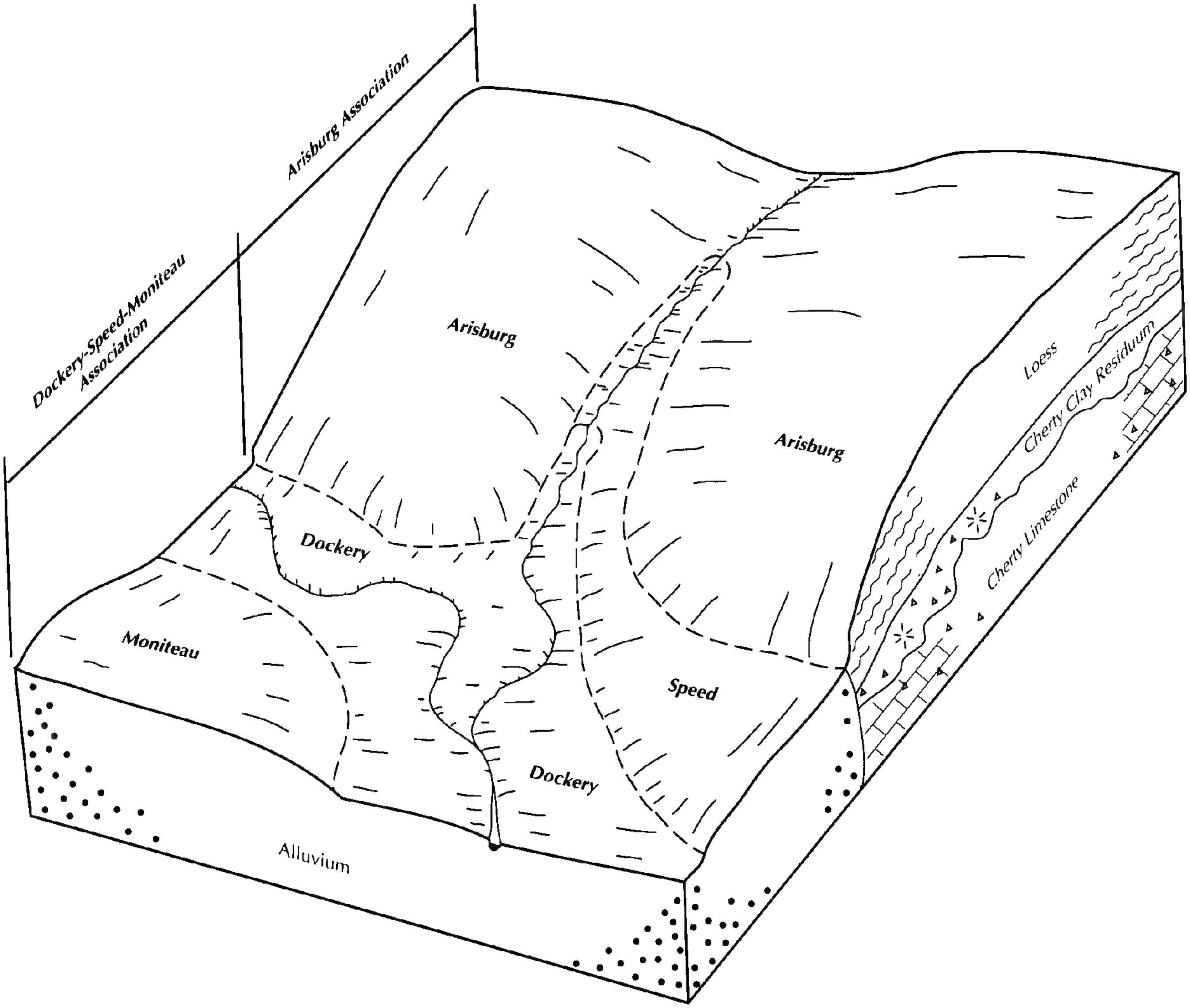

Figure 4.—Typical pattern of soils and parent material in the Dockery-Speed-Moniteau association and the Arisburg association.

drainageways. Slopes range from 1 to 9 percent. This association makes up about 3 percent of the survey area. It is about 73 percent Arisburg soils and 27 percent soils of minor extent (fig. 4).

Arisburg soils generally are on broad summits. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:

0 to 6 inches, very dark gray, very friable silt loam

Subsurface layer:

6 to 19 inches, very dark gray, friable silt loam and firm silty clay loam

Subsoil:

19 to 56 inches, dark grayish brown and grayish brown, mottled, very firm silty clay loam and silty clay

Substratum:

56 to 60 inches, grayish brown, mottled, firm silty clay loam

Of minor extent in this association are Leslie, Wakenda, and Weller soils. Leslie soils have a leached subsurface layer. They are on the broader summits. Wakenda soils have less clay in the subsoil than the Arisburg soils. They are on the narrower, rounded

summits. Weller soils have a light colored surface layer. They are on the steeper back slopes in the more dissected areas.

Grain farming is the main enterprise in areas of this association. Soybeans, corn, and winter wheat are the major crops. Grasses and wetness-tolerant legumes are grown on a small acreage. The hazard of erosion, drainage of seepy areas, and wetness are the major management concerns.

If these soils are used for building site development or onsite waste disposal systems, the wetness, restricted permeability, and the shrink-swell potential are the major concerns.

5. Clafork-Leslie-Crestmeade Association

Very deep, nearly level to moderately sloping, somewhat poorly drained and poorly drained soils that formed in loess or in loess and cherty limestone residuum; on uplands

The soils in this association are on summits, back slopes, and foot slopes. Slopes range from 1 to 8 percent. This association makes up about 30 percent of the survey area. It is about 45 percent Clafork and similar soils, 24 percent Leslie and similar soils, 16 percent Crestmeade and similar soils, and 15 percent soils of minor extent (fig. 5).

The somewhat poorly drained Clafork soils are on summits and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:
8 to 11 inches, brown, mottled, friable silt loam

Subsoil:
11 to 39 inches, mottled, dark yellowish brown, grayish brown, and dark grayish brown, firm silty clay loam and silty clay
39 to 59 inches, dense layer of mottled, grayish brown and yellowish brown, very firm, brittle silty clay loam and silt loam
59 to 72 inches, dense layer of grayish brown, mottled, firm, brittle very gravelly silt loam
72 to 80 inches, red and dark red, very firm very gravelly silty clay

The somewhat poorly drained and poorly drained Leslie soils are on summits, back slopes, and foot slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 11 inches, very dark gray, friable silt loam

Subsurface layer:
11 to 16 inches, dark grayish brown, mottled, friable silt loam

Subsoil:
16 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam and silty clay

The somewhat poorly drained Crestmeade soils are on broad summits and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 11 inches, very dark grayish brown, friable silt loam

Subsurface layer:
11 to 18 inches, dark grayish brown, friable silt loam

Subsoil:
18 to 34 inches, mottled, dark brown and dark grayish brown, firm silty clay
34 to 52 inches, grayish brown, mottled, firm silty clay loam

Substratum:
52 to 60 inches, gray, mottled, firm silty clay loam

Of minor extent in this association are Bunceton, Dameron, and Chauncey soils. The well drained Bunceton soils are on narrow summits and back slopes below the Clafork soils. The well drained Dameron soils are on narrow, low flood plains below the Clafork soils. Chauncey soils have a thicker, leached light gray subsurface layer than the Crestmeade soils. They are on foot slopes below the Crestmeade soils.

Grain farming is the main enterprise in areas of this association. Soybeans, corn, and winter wheat are the major crops. The hazard of erosion, wetness, and soil blowing are the major management concerns.

If these soils are used for building site development or onsite waste disposal systems, the wetness, restricted permeability, and the shrink-swell potential are the major concerns.

6. Goss-Wrengart-Bluelick Association

Very deep, gently sloping to very steep, well drained and moderately well drained soils that formed in cherty limestone residuum or in loess and cherty limestone residuum; on uplands

The soils in this association are on narrow summits and highly dissected shoulders and back slopes

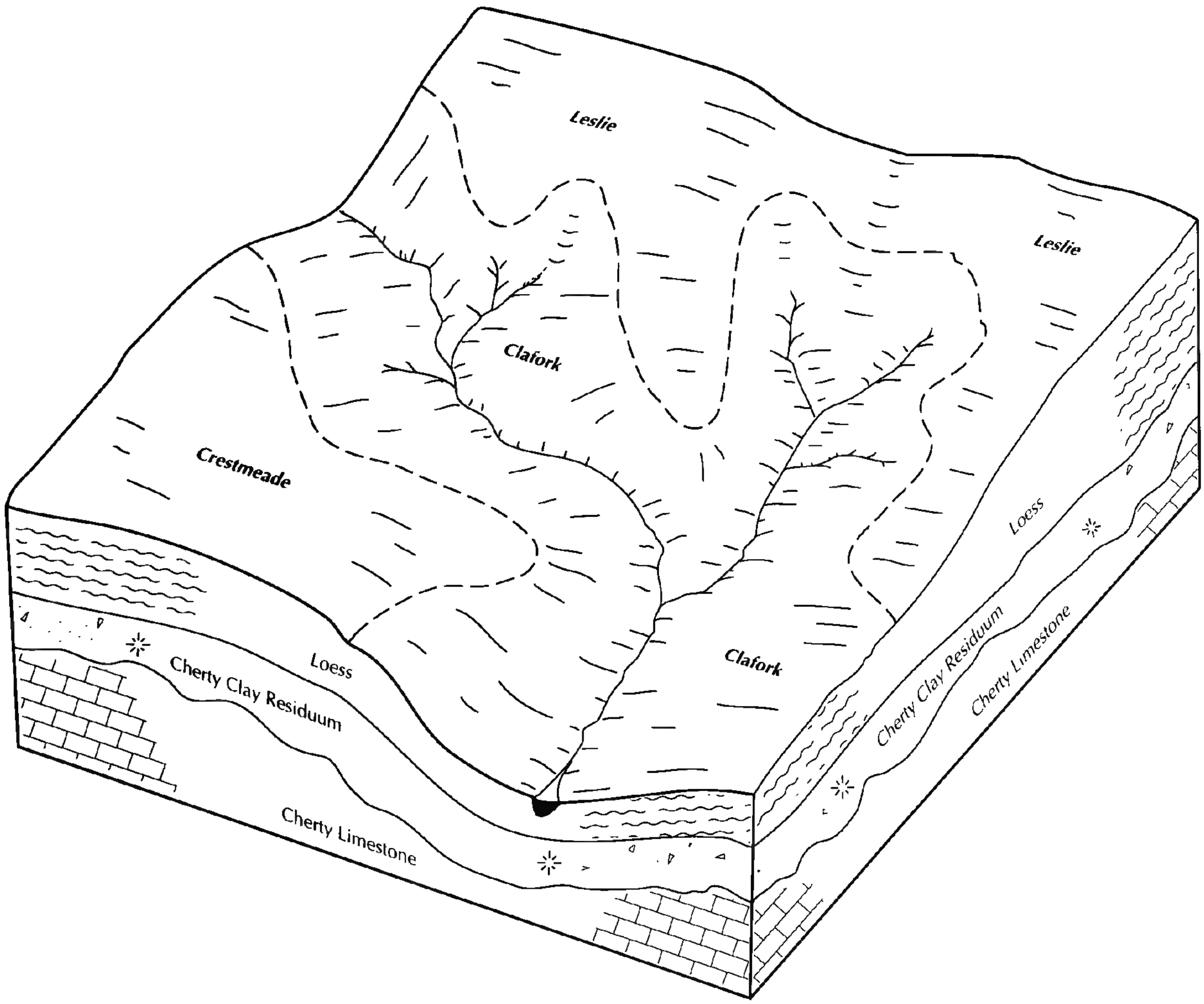

Figure 5.—Typical pattern of soils and parent material in the Clafork-Leslie-Crestmeade association.

adjacent to the Lamine River and Moniteau Creek and their tributaries. Summits are long and narrow. Drainageways are deep and V-shaped and have narrow flood plains. This association makes up about 29 percent of the survey area. It is about 28 percent Goss soils, 24 percent Wrengart soils, 17 percent Bluelick and similar soils, and 31 percent soils of minor extent (fig. 6).

Goss soils are on narrow summits, shoulders, and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:

0 to 4 inches, dark brown, friable gravelly silt loam

Subsurface layer:

4 to 21 inches, yellowish brown and brown, mottled, friable very gravelly silt loam

Subsoil:

21 to 29 inches, strong brown very gravelly silt loam

29 to 44 inches, yellowish red and dark red, very firm very gravelly clay

44 to 60 inches, dark red, very firm gravelly clay

Wrengart soils are on summits, shoulders, and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

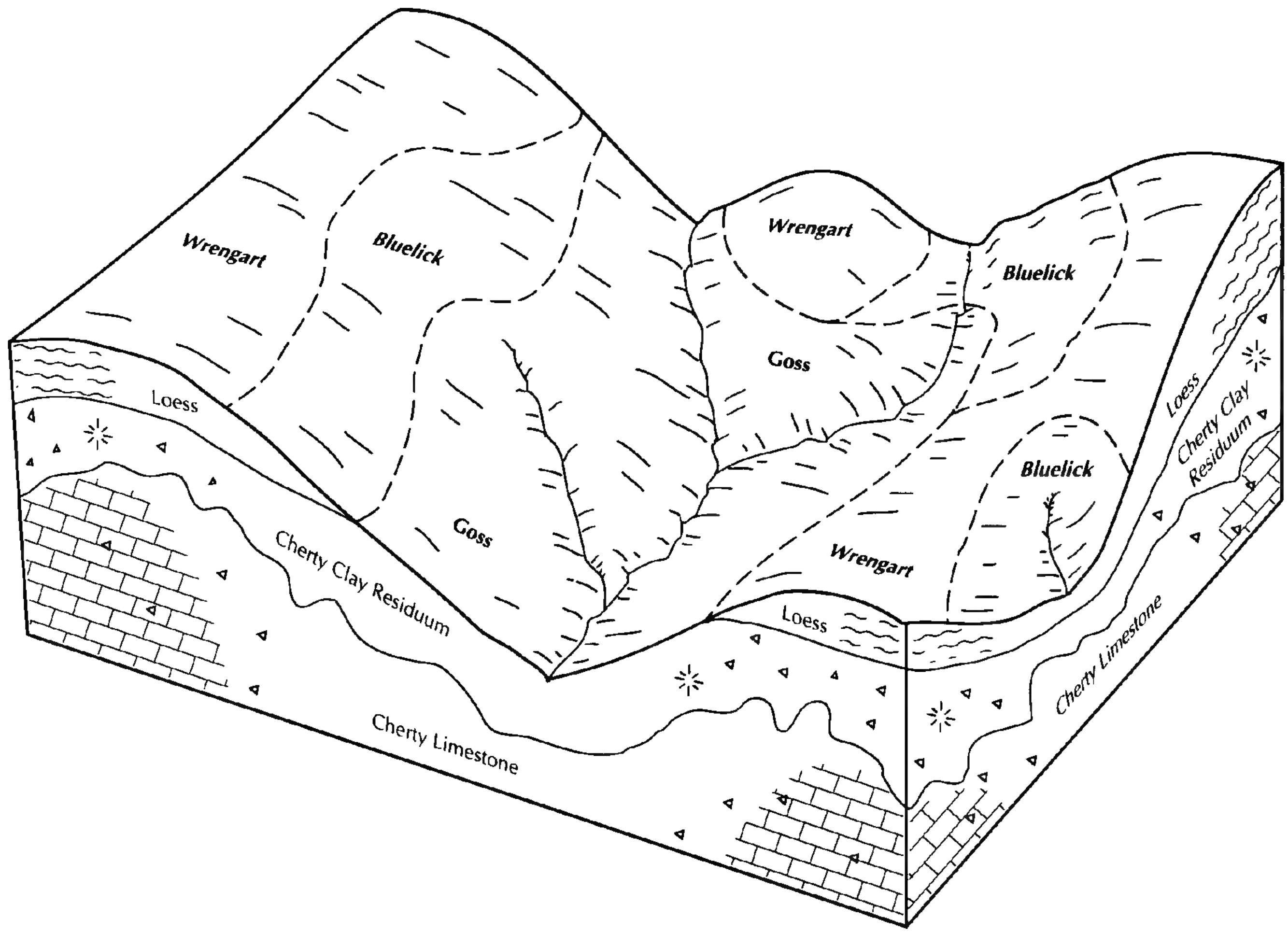

Figure 6.—Typical pattern of soils and parent material in the Goss-Wrengart-Bluelick association.

Surface layer:
- 0 to 6 inches, dark brown, friable silt loam

Subsoil:
- 6 to 16 inches, dark yellowish brown, friable silt loam and firm silty clay loam
- 16 to 26 inches, dark yellowish brown, mottled, firm silty clay loam
- 26 to 45 inches, dense layer of dark yellowish brown, mottled, firm, brittle silt loam
- 45 to 60 inches, yellowish brown, mottled, firm extremely gravelly silty clay loam
- 60 to 80 inches, red, mottled, firm gravelly silty clay

Bluelick soils are on summits, shoulders, and back slopes. The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
- 0 to 7 inches, brown, friable silt loam

Subsoil:
- 7 to 11 inches, dark yellowish brown, firm silty clay loam
- 11 to 26 inches, strong brown and yellowish red, firm silty clay loam
- 26 to 38 inches, red, very firm very gravelly silty clay
- 38 to 60 inches, dark red, very firm extremely gravelly and very gravelly clay

Of minor extent in this association are Cotton and Dameron soils. Cotton soils have grayish mottles in the upper part of the subsoil. They are on the broader summits above the Wrengart soils. Dameron soils have a very dark grayish brown surface layer. They are on narrow, low flood plains below the Goss soils.

The soils in this association are used mainly as pasture or woodland. Some of the gently sloping and moderately sloping areas are used for row crops.

Most of the commonly grown legumes and cool-season grasses grow well or moderately well in areas used for forage crops or for pasture and hay. Erosion control during and after establishment is the main management concern. Droughtiness and rock fragments on the surface are also concerns in areas of gravelly soils.

The soils in this association are suited to trees. Many of the moderately steep and steep areas support hardwood forest. The slope is a concern affecting the use of mechanical harvesting and planting equipment. Seedling mortality is also a management concern.

The gently sloping and moderately sloping areas can be used for cultivated crops. Water erosion and wetness are the main concerns.

The soils in this association are suited to woodland wildlife habitat. Planting food plots and protecting wildlife areas and timber areas from grazing and fires enhance the production of food and cover for wildlife.

The gently sloping to strongly sloping areas can be used for building site development or onsite waste disposal systems. The wetness, the shrink-swell potential, restricted permeability, large stones, and the slope are the main limitations. The steeper soils generally are not used for building site development or onsite waste disposal systems.

Detailed Soil Map Units

The map units on the detailed soil maps in this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Menfro silt loam, 3 to 9 percent slopes, eroded, is a phase of the Menfro series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Haynie-Waldron complex, occasionally flooded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10—Ackmore silt loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are long and narrow and range from 10 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 9 inches, very dark grayish brown, friable silt loam

Substratum:
- 9 to 24 inches, layered very dark gray and grayish brown, friable silt loam

Buried surface layer:
- 24 to 60 inches, very dark gray and black, firm silty clay loam

In some areas the buried surface layer is at a depth of more than 36 inches.

Included with this soil in mapping are small areas of Dockery and Zook soils. These soils do not have a buried surface layer. Dockery soils are lower on the

landscape than the Ackmore soil. The poorly drained Zook soils are in concave areas adjacent to the Ackmore soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Ackmore soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At a depth of 1 to 3 feet
Shrink-swell potential: High in the lower part

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. The occasional flooding is a management concern. Spring flooding may delay tillage, and areas that are plowed in the fall may be subject to scouring during periods of flooding. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; to cool-season grasses, such as reed canarygrass; and to warm-season grasses, such as switchgrass. Wetness and flooding are the main management concerns affecting hay and pasture. Wetness-tolerant plants should be selected. A good seedbed can be easily prepared. A drainage system is beneficial for deep-rooted species.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 3A.

11B—Arisburg silt loam, 1 to 5 percent slopes. This very deep, very gently sloping and gently sloping, somewhat poorly drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark gray, very friable silt loam

Subsurface layer:
8 to 19 inches, very dark gray, friable silt loam and firm silty clay loam

Subsoil:
19 to 56 inches, dark grayish brown and grayish brown, mottled, very firm silty clay loam and silty clay

Substratum:
56 to 60 inches, grayish brown, mottled, firm silty clay loam

In some areas the very dark gray surface layer and subsurface layer are less than 16 inches thick. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Leslie and Wakenda soils. Leslie soils have a dark grayish brown subsurface layer. They are in depressional areas. Wakenda soils are well drained and are in the higher convex areas. Included soils make up about 10 percent of the unit.

Important properties of the Arisburg soil—

Permeability: Moderately slow
Surface runoff: Slow or medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few small areas are used for hay and pasture crops. This soil is well suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, and conservation cropping systems that include rotations of pasture, hay, or winter wheat. Nearly all areas have slopes that are long enough to be terraced and farmed on the contour. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth bromegrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil can be used for building site development or onsite waste disposal systems, but the high shrink-swell

potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but sealing the berms and bottom of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

11B2—Arisburg silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil commonly is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark gray, friable silt loam

Subsoil:
8 to 11 inches, very dark gray, firm silty clay loam
11 to 26 inches, dark grayish brown, mottled, firm silty clay loam and silty clay
26 to 50 inches, grayish brown, mottled, firm silty clay loam

Substratum:
50 to 60 inches, grayish brown, mottled, firm silty clay loam

In places the very dark gray surface layer and the upper part of the subsoil are less than 10 inches thick. In some areas the surface layer is silty clay loam as a result of erosion.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer at a depth of 20 to 40 inches. They are in the steeper areas. They make up about 5 to 10 percent of the unit.

Important properties of the Arisburg soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture, hay, or wheat. Grassed waterways generally require some type of grade-stabilization structure. Some areas are wet and seepy, but properly placed tile drains help to minimize this problem. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth bromegrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to control erosion.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is generally unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

11C2—Arisburg silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil commonly is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 9 inches, very dark gray, friable silt loam

Subsoil:

9 to 32 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

32 to 41 inches, light brownish gray, mottled, firm silty clay loam

Substratum:

41 to 60 inches, light brownish gray, mottled, firm silty clay loam

In places the very dark gray surface layer is more than 10 inches thick. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer at a depth of 20 to 40 inches. They are in the steeper areas. They make up about 5 to 10 percent of the unit.

Important properties of the Arisburg soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture, hay, or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Some areas are wet and seepy, but properly placed tile drains help to minimize this problem. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth bromegrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to control erosion.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential, the wetness, and the slope are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. The soil generally is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function adequately, but leveling of the site may be necessary. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

13B—Jemerson silt loam, 2 to 5 percent slopes, rarely flooded. This very deep, gently sloping, well drained soil commonly is on alluvial fans. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, dark brown, friable silt loam

Subsurface layer:
9 to 16 inches, dark brown, friable silt loam

Subsoil:
16 to 60 inches, dark brown, firm silt loam and silty clay loam

In some areas the surface layer is very dark grayish brown. In other areas the surface layer is thicker.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Freeburg soils. Dockery soils are on low flood plains along small streams. They are not characterized by an increase in clay content with increasing depth. Freeburg soils are in landscape positions similar to those of the Jemerson soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Jemerson soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderately low
Seasonal high water table: At a depth of 3.5 to 5.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans (fig. 7), grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of water erosion is the major management concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture, hay, or wheat crops. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. Diversion terraces may be needed to intercept runoff from adjacent areas.

This soil is well suited to the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure a good ground cover. Measures that maintain fertility and that control brush are needed.

This soil is well suited to trees. No major hazards or limitations affect timber management.

This soil generally is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIe. The woodland ordination symbol is 3A.

15D2—Newcomer silt loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, well drained soil is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to 95 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsoil:
8 to 14 inches, dark yellowish brown, firm silt loam
14 to 28 inches, yellowish brown, mottled, firm clay loam

Bedrock:
28 to 60 inches, weathered sandstone

In some areas the surface layer is brown. In other areas the depth to sandstone bedrock is more than 40 inches.

Included with this soil in mapping are small areas of the very deep Wakenda soils and areas of Winfield soils. Wakenda soils are in the higher, less sloping areas. The moderately well drained Winfield soils are in landscape positions similar to those of the Newcomer soil. Included soils make up about 5 percent of the unit.

Important properties of the Newcomer soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used as pasture. Some areas are cultivated along with areas of surrounding soils. A few areas are wooded. This soil is suited to cultivated crops

Figure 7.—Soybeans in an area of Jemerson silt loam, 2 to 5 percent slopes, rarely flooded. The Goss-Wrengart-Bluelick association is in the background.

only on a limited basis because of the slope and a severe hazard of erosion. It is suited to pasture and hay crops.

Growing pasture and hay crops helps to control erosion. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. Shallow-rooted species that can tolerate droughtiness should be selected. Erosion control is a major management concern when seedings are established. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil can be used for building site development or onsite waste disposal systems, but the depth to bedrock, the slope, and the shrink-swell potential are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed on the bedrock, and soil can be shaped around the building; or the bedrock should be excavated. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings and foundations helps to remove excess water. Some land grading may be necessary to modify the slope. Conventional septic tank absorption fields can function adequately in areas of this soil. Mounding

suitable soil material increases the thickness of soil material over the bedrock, and the lateral lines should be installed across the slope. Also, areas that are better suited can be selected as sites for the disposal of sewage effluent.

Low strength, the shrink-swell potential, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Also, the roads should be designed so that they conform to the slope. Some cut and fill may be necessary because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3A.

15F—Newcomer silt loam, 14 to 35 percent slopes. This moderately deep, moderately steep and steep, well drained soil is on the back slopes of ridges in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:
8 to 14 inches, dark brown, friable silt loam

Subsoil:
14 to 24 inches, yellowish brown, friable silt loam

Bedrock:
24 inches, weathered sandstone

In some areas the depth to bedrock is more than 40 inches. In other areas the surface layer is brown.

Included with this soil in mapping are small areas of the very deep Knox soils. These soils are in the less sloping areas above the Newcomer soil. They make up about 5 percent of the unit.

Important properties of the Newcomer soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas of this soil are wooded. A few small areas are used for pasture. This soil generally is unsuited to cultivated crops because of the slope and the severe hazard of erosion.

This soil is suited to trees. The erosion hazard, equipment limitations, and seedling mortality are the main management concerns. Constructing roads and skid trails on the contour and installing water bars help to minimize the steepness and length of slopes and the concentration of water. It may be necessary to seed disturbed areas after harvesting is completed. Because of the slope, the use of equipment is hazardous. In extreme cases, yarding the logs uphill to logging roads or skid trails may be necessary. Planting by hand or using container-grown stock reduces the seedling mortality rate.

Growing pasture and hay crops helps to control erosion. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiangrass. Shallow-rooted species that can tolerate droughtiness should be selected. Erosion control is a serious concern when seedings are established. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife, especially small-seed grain, is scarce. Timely plantings of food plots improve the amount and quality of food available for wildlife. Food plots can be planted at the edge of the woodland or in other fringe areas or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

17C2—Bluelick silt loam, 3 to 8 percent slopes, eroded. This very deep, gently sloping and moderately sloping, well drained soil commonly is on the summits and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to about 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, brown, friable silt loam

Subsoil:
- 8 to 34 inches, brown and strong brown, firm silty clay loam
- 34 to 60 inches, strong brown and yellowish red, very firm extremely gravelly silty clay

In some areas the subsoil contains less clay. In other areas the gravelly layer is at a depth of less than 20 inches.

Included with this soil in mapping are small areas of Wrengart and Winfield soils. These soils are in landscape positions similar to those of the Bluelick soil. Wrengart soils have a dense layer in the subsoil. Winfield soils are moderately well drained. Included soils make up about 10 percent of the unit.

Important properties of the Bluelick soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used as pasture or cropland. A few areas are used as woodland. This soil is suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover. Measures that maintain fertility and that control brush are necessary.

This soil is suited to corn, soybeans, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, winter cover crops, contour farming, and conservation cropping systems that include rotations of pasture, hay, or wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Some areas support stands of native hardwoods. No major hazards or limitations affect timber management.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but timely plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of woodland or in other fringe areas. Wildlife areas should be protected from grazing and from fire.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. Conventional septic tank absorption fields can function adequately if lateral lines are installed across the slope. Also, increasing the size of the absorption field helps to compensate for the restricted permeability. Sewage lagoons also function adequately if the site can be leveled and the bottom is sealed with slowly permeable material.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

17D2—Bluelick silt loam, 8 to 15 percent slopes, eroded. This very deep, strongly sloping, well drained soil commonly is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to about 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 7 inches, brown, friable silt loam

Subsoil:
- 7 to 22 inches, dark yellowish brown and strong brown, firm silty clay loam
- 22 to 33 inches, yellowish red, firm silty clay
- 33 to 42 inches, yellowish red, very firm very gravelly silty clay
- 42 to 60 inches, red, very firm extremely gravelly clay

In some areas the subsoil contains less clay. In other

areas the gravelly layer is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Goss, Wrengart, and Winfield soils. Goss soils have gravel throughout. They are in the steeper areas. Wrengart and Winfield soils are in landscape positions similar to those of the Bluelick soil. Wrengart soils have a dense layer in the subsoil. Winfield soils are moderately well drained. Included soils make up about 10 percent of the unit.

Important properties of the Bluelick soil—

Permeability: Moderately slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used as pasture or woodland. This soil is suited to cultivated crops only on a limited basis because of the slope and the severe hazard of erosion. It is suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover. Measures that maintain fertility and that control brush are necessary.

This soil is suited to trees. Some areas support stands of native hardwoods. No major hazards or limitations affect timber management.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, and timely plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of woodland or in other fringe areas. Wildlife areas should be protected from grazing and from fire.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and the slope are moderate limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the foundation helps to remove excess water. Some land grading generally is necessary to modify the slope. Septic tank absorption fields can function adequately if lateral lines are installed across the slope. Also, increasing the size of the absorption field helps to compensate for the restricted permeability.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

17E2—Bluelick silt loam, 15 to 25 percent slopes, eroded. This very deep, moderately steep and steep, well drained soil commonly is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer. Individual areas of this soil are irregular in shape and range from 5 to about 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, brown, friable silt loam

Subsoil:
7 to 11 inches, dark yellowish brown, firm silty clay loam
11 to 26 inches, strong brown and yellowish red, firm silty clay loam
26 to 38 inches, red, very firm very gravelly silty clay
38 to 60 inches, dark red, very firm extremely gravelly and very gravelly clay

In some areas the gravelly layer is within a depth of 20 inches. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Goss and Winfield soils. Goss soils have gravel throughout. They are in the steeper areas. The moderately well drained Winfield soils are in the less sloping areas. Included soils make up about 10 percent of the unit.

Important properties of the Bluelick soil—

Permeability: Moderately slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few areas are used for

pasture. This soil generally is unsuited to cultivated crops because of the slope and the severe hazard of erosion. It is suited to trees, and several areas support stands of native hardwoods. The main management concerns are the erosion hazard and equipment limitations. Constructing roads and skid trails on the contour helps to overcome the equipment limitations and helps to prevent further erosion by minimizing the concentration of water. It may be necessary to seed disturbed areas after harvest.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover. Measures that maintain fertility and that control brush are necessary.

This soil is suited to the development of woodland wildlife habitat. The soil provides adequate cover, but forage for wildlife, especially small-seed grain, is scarce. Timely plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of the woodland or in other fringe areas. Wildlife areas should be protected from grazing and from fire.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

20—Bremer silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are generally long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 14 inches, very dark gray, friable silt loam

Subsoil:
- 14 to 29 inches, very dark gray, mottled, firm silty clay loam and very firm silty clay
- 29 to 60 inches, mottled, dark grayish brown, grayish brown, and light brownish gray, very firm and firm silty clay loam

In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Ackmore and Speed soils. Ackmore soils have a buried soil at a depth of 18 to 36 inches. They are on low flood plains. Speed soils have a leached subsurface horizon. They are on high flood plains between the Ackmore and Bremer soils. Included soils make up about 5 percent of the unit.

Important properties of the Bremer soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: At a depth of 1 to 2 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used as pasture. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. Wetness and flooding are the main limitations. If cultivated crops are grown, a drainage system is needed in depressional areas. The flooding and the wetness may delay tillage in the spring, and areas that are plowed in the fall may be susceptible to scouring during periods of flooding. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from the uplands. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes surface crusting, and increases the rate of water infiltration.

This soil is suited to pasture. It is best suited to wetness-tolerant, shallow-rooted legumes, such as alsike clover and ladino clover, and to cool-season grasses, such as bluegrass and redtop. Warm-season grasses that can tolerate wetness, such as switchgrass, are suitable. The wetness and the flooding are the main management concerns. The soil is poorly suited to the production of hay. Grazing systems should be designed around periods of possible flooding. Maintaining stands of desirable species is difficult in depressional areas. A drainage system is beneficial for deep-rooted species.

This soil is suited to wetness-tolerant trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Ridging the soil and planting on the ridges improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 7W.

25A—Chauncey silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping,

poorly drained soil is on the foot slopes of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches, very dark gray, friable silt loam

Subsurface layer:
12 to 26 inches, grayish brown, mottled, friable silt loam

Subsoil:
26 to 47 inches, dark grayish brown, mottled, firm silty clay
47 to 60 inches, grayish brown, mottled, firm silty clay loam

In some areas the subsoil contains less clay. In other areas the subsurface layer is thinner.

Included with this soil in mapping are small areas of Dameron soils. These soils have less clay in the lower part than the Chauncey soil. They are adjacent to drainageways. They make up about 10 percent of the unit.

Important properties of the Chauncey soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at the surface to 2 feet below the surface
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If row crops are grown, wetness is the main management concern. Diversion terraces may be needed to intercept runoff from the uplands. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to pasture and hay crops. It is moderately suited to wetness-tolerant, shallow-rooted legumes, such as ladino clover and alsike clover, and to cool-season grasses, such as tall fescue. It is moderately suited to warm-season grasses, such as switchgrass. The wetness is the main concern. Maintaining stands of desirable species is difficult in depressional areas. A drainage system is beneficial for deep-rooted species.

This soil is suited to wetness-tolerant trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Ridging the soil and planting on the ridges improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil generally is not used for building site development or onsite waste disposal systems because of the wetness and the shrink-swell potential. Alternate sites that are better suited are generally available.

The land capability classification is IIw. The woodland ordination symbol is 4W.

27B—Clafork silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:
8 to 11 inches, brown, mottled, friable silt loam

Subsoil:
11 to 39 inches, mottled, dark yellowish brown, grayish brown, and dark grayish brown, firm silty clay loam and silty clay
39 to 59 inches, dense layer of mottled, grayish brown and yellowish brown, very firm, brittle silty clay loam and silt loam
59 to 72 inches, dense layer of grayish brown, mottled, firm, brittle very gravelly silt loam
72 to 80 inches, red and dark red, very firm very gravelly silty clay

In some areas the very dark grayish brown surface layer is more than 10 inches thick. In other areas the surface layer is brown. In places the gravelly subsoil is at a depth of more than 60 inches.

Included with this soil in mapping are small areas of Bunceton, Crestmeade, and Glensted soils. Bunceton soils are well drained and are in convex areas. Crestmeade soils have a thicker surface layer than the Clafork soil. They are in the higher, flatter areas. Glensted soils are poorly drained and are in concave areas. Included soils make up about 5 percent of the unit.

Important properties of the Clafork soil—

Permeability: Moderately slow
Surface runoff: Medium

Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. The dense layer in the subsoil may restrict rooting depth and can result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. No hazards or limitations affect woodland management.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function adequately if they are sealed, or alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

27B2—Clafork silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsoil:
7 to 25 inches, mottled brown, dark yellowish brown, yellowish brown, and dark grayish brown, firm and very firm silty clay loam and silty clay
25 to 51 inches, dense layer of mottled grayish brown and yellowish brown, firm, brittle silt loam
51 to 60 inches, strong brown, mottled, firm extremely gravelly silty clay loam

In some areas the subsoil does not have a dense layer. In other areas, the upper part of the subsoil does not have dark grayish brown mottles and the subsoil contains less clay.

Included with this soil in mapping are small areas of the poorly drained Chauncey and Glensted soils. Chauncey soils are on concave foot slopes below the Clafork soil. Glensted soils are on the back slopes of ridges. Included soils make up about 5 percent of the unit.

Important properties of the Clafork soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion

is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. The dense layer in the subsoil can restrict rooting depth and may result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. No major hazards or limitations affect harvesting or planting.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but lining the bottom with slowly permeable material helps to prevent the contamination of ground water. Also, alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

27C2—Clafork silt loam, 5 to 8 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silt loam

Subsoil:

8 to 13 inches, brown, mottled, firm silty clay loam
13 to 24 inches, mottled dark yellowish brown, dark grayish brown, and grayish brown, very firm silty clay and silty clay loam
24 to 49 inches, dense layer of mottled grayish brown and yellowish brown, firm, brittle silt loam
49 to 54 inches, mottled yellowish brown and strong brown, firm extremely gravelly silt loam
54 to 60 inches, yellowish red, very firm very gravelly clay

In some areas the subsoil does not have a dense layer. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the well drained Bunceton and Eldon soils. Bunceton soils are in convex areas. Eldon soils are in the steeper areas. Included soils make up about 5 percent of the unit.

Important properties of the Clafork soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Terraces are suitable in most areas, but deep

cutting can expose gravel in some places. Grassed waterways generally require some type of grade-stabilization structure. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. The dense layer in the subsoil may restrict rooting depth and can result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but leveling may be needed. Also, sealing the bottom of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

28A—Dameron silt loam, 0 to 3 percent slopes, occasionally flooded. This very deep, nearly level and very gently sloping, well drained soil is on flood plains along small streams. It is subject to flooding for brief periods. Individual areas are long and narrow and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:
8 to 28 inches, very dark grayish brown, friable silt loam

Substratum:
28 to 60 inches, very dark grayish brown, firm very gravelly silty clay loam and very gravelly clay loam

In some areas the surface layer is gravelly.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Speed soils and the moderately well drained Wrengart soils. Dockery soils are in landscape positions similar to those of the Dameron soil. Speed soils are in the higher areas. Wrengart soils have a dense layer in the subsoil. They are in the steeper areas. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Dameron soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops or as woodland. A few areas are used for row crops. This soil is well suited to most of the commonly grown legumes, such as ladino clover; to cool-season grasses, such as tall fescue and bluegrass; and to warm-season grasses, such as big bluestem and switchgrass. Summer droughtiness and the flooding are the main management concerns. Planting wetness-tolerant species helps to maintain the stands. Maintaining a cover of vegetation and properly managing streambanks help to prevent stream scour and other kinds of flood damage. Proper fertilization, pasture rotation, controlled stocking rates, and restricted grazing during dry periods improve forage quality and production and help to keep the pasture in good condition.

This soil is suited to trees. No major hazards or limitations affect timber management.

If this soil is used for cultivated crops, the occasional flooding from late fall to early spring and the

droughtiness that can occur during the growing season are major management concerns. The flooding may delay planting, and areas that are plowed in the fall may be subject to scouring. Small fields and limited access also restrict tillage. Planting winter cover crops and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to prevent flood damage and conserve soil moisture.

Most areas are suited to habitat for openland and woodland wildlife. Grain fields, idle land, and wooded areas that border fences and drainageways provide good cover and an adequate supply of food. If grazing can be controlled, plantings of food plots in cleared areas increase the food supply. Placing the waste products of timber cutting and land clearing in dense brush piles in areas of the adjacent uplands can provide secure winter cover for many species of wildlife.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A.

29—Darwin silty clay, occasionally flooded. This very deep, nearly level, poorly drained soil commonly is in backswamps on high flood plains along the Missouri River. It is subject to flooding for brief or long periods. Individual areas are irregular in shape and range from 5 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, very dark gray, firm silty clay

Subsoil:
10 to 60 inches, dark gray and dark grayish brown, mottled, very firm silty clay

In places the very dark gray surface layer is less than 10 inches thick. In a few areas the lower part of the subsoil is very fine sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Leta soils. These soils have less clay in the subsoil than the Darwin soil. They are in the higher areas. They make up about 5 percent of the unit.

Important properties of the Darwin soil—

Permeability: Very slow
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: 1 foot above to 2 feet below the surface
Shrink-swell potential: Very high

Nearly all areas are used for cultivated crops. This soil is suited to soybeans and winter wheat. Corn and grain sorghum are also grown. Wetness and flooding are the main management concerns. In places, surface runoff is very slow and the surface is covered with water after hard rains or as a result of runoff from adjacent areas. Varieties of row crops that require a short growing season are best suited. Tillage is difficult, and a seedbed should be prepared only under the optimum soil moisture conditions. Surface ditches or land leveling and timely tillage can improve yields. Fall plowing improves tilth and allows for easier tillage in the spring. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the soil is dry or frozen. Ridging the soil and planting on the ridges increase seedling survival rates. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is well suited to wetland wildlife habitat. Wetland vegetation for food and cover grows well. Wetland plants can establish themselves in 3 to 5 years, or they can be planted by seed or root stock. Shallow impoundments can be constructed by damming up drainageways or by building berms around the intended area. Good wetland habitat consists of about 50 percent open water and 50 percent emergent vegetation. Mowing when the area is dry or keeping the water level at a depth of 3.5 feet over half of the area and at a shallower depth over the other half helps to maintain the habitat. Opening or closing an outlet installed in the berm or dam regulates the water depth in the impoundment (Hanor).

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

30—Dockery silt loam, frequently flooded. This very deep, nearly level, somewhat poorly drained soil is on low flood plains along small streams. It is subject to flooding for brief periods. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Substratum:
7 to 38 inches, dark brown and very dark gray, mottled, friable silt loam
38 to 60 inches, layered very dark grayish brown, dark grayish brown, and grayish brown, mottled, friable silt loam

In some areas the substratum contains less clay.

Included with this soil in mapping are small areas of Speed soils and areas of the poorly drained Moniteau and well drained Sturkie soils. Speed and Moniteau soils are on higher flood plains than the Dockery soil. Speed soils have a leached subsurface layer. Sturkie soils are in the higher convex areas. Included soils make up about 10 percent of the unit.

Important properties of the Dockery soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At a depth of 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas of this soil are used for cultivated crops or for pasture and hay crops. A few areas are wooded. The hazard of flooding is severe. The flooding may delay tillage in the spring, and areas that are plowed in the fall may be subject to scouring during periods of flooding. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Maintaining a cover of vegetation and properly managing streambanks help to prevent stream scour and other kinds of flood damage. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is moderately well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as switchgrass. Varieties that can tolerate the flooding and the seasonal high water table should be selected. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Except for the flooding, which affects the use of equipment, no major limitations or hazards affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding (fig. 8).

The land capability classification is IIIw. The woodland ordination symbol is 4W.

32A—Crestmeade silt loam, 0 to 2 percent slopes. This very deep, nearly level, somewhat poorly drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches, very dark grayish brown, friable silt loam

Subsurface layer:
11 to 18 inches, dark grayish brown, friable silt loam

Subsoil:
18 to 34 inches, dark brown and dark grayish brown, mottled, firm silty clay
34 to 52 inches, grayish brown, mottled, firm silty clay loam

Substratum:
52 to 60 inches, gray, mottled, firm silty clay loam

In some areas the very dark grayish brown surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer in the subsoil. They are in the steeper areas. They make up about 5 percent of the unit.

Important properties of the Crestmeade soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If row crops are grown, erosion is the main management concern. Restricting fall plowing and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to pasture and hay crops. It is moderately suited to wetness-tolerant, shallow-rooted legumes, such as ladino clover and alsike clover, and to cool-season grasses, such as tall fescue. It is moderately suited to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Wetness is the

Figure 8.—Flooding in an area of Dockery silt loam, frequently flooded.

main concern. A drainage system is beneficial for deep-rooted species.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

32B2—Crestmeade silt loam, 1 to 4 percent slopes, eroded. This very deep, very gently sloping, somewhat poorly drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 16 inches, dark brown, mottled, firm silty clay
16 to 24 inches, mottled, dark grayish brown and brown, firm silty clay
24 to 44 inches, grayish brown, mottled, firm silty clay loam

Substratum:
44 to 60 inches, gray, mottled, friable silt loam

In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer in the subsoil. They are in the steeper areas. They make up about 5 percent of the unit.

Important properties of the Crestmeade soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, terraces combined with grassed waterways or tile outlets, contour farming, winter cover crops, and a conservation cropping system that includes rotations of pasture, hay, or wheat crops. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is moderately suited to wetness-tolerant, shallow-rooted legumes, such as ladino clover and alsike clover; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

33—Eudora loam, sandy substratum, occasionally flooded. This very deep, nearly level, well drained soil commonly is on natural levees on high flood plains along the Missouri River. It is protected by levees but is subject to flooding for brief periods because of levee breaks or runoff from adjacent areas. Individual areas are long and narrow and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, very dark grayish brown, friable loam

Subsurface layer:
10 to 17 inches, very dark grayish brown, friable loam

Subsoil:
17 to 54 inches, dark brown and brown, friable silt loam and dark brown, friable loam

Substratum:
54 to 60 inches, brown, very friable loamy fine sand

In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the poorly drained Darwin and somewhat poorly drained Leta soils. Darwin and Leta soils are in the lower areas. They contain more clay in the subsoil than the Eudora

soil. They make up about 10 percent of the unit.

Important properties of the Eudora soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. Flooding may cause crop loss in some years.

This soil is suited to grasses and legumes for pasture and hay. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. The flooding is a concern affecting pasture and hay crops, but crop damage generally is minimal during the growing season.

This soil is suited to trees. No major limitations or hazards affect timber management.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 10A.

34D—Eldon gravelly silt loam, 8 to 15 percent slopes. This very deep, strongly sloping, well drained soil is on the shoulders and back slopes of ridges in the uplands. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable gravelly silt loam

Subsoil:
6 to 18 inches, dark brown, friable gravelly silt loam
18 to 36 inches, dark brown and yellowish red, mottled, firm extremely gravelly silty clay and extremely gravelly clay
36 to 60 inches, red, mottled, very firm extremely gravelly clay and clay

In some areas bedrock is at a depth of 40 to 60 inches. In places, the surface layer is thicker and the upper part of the subsoil is not gravelly.

Included with this soil in mapping are small areas of Bluelick, Bunceton, and Moko soils. Bluelick and Bunceton soils do not have gravel in the upper 20 to 40 inches. They are in the less sloping areas. Moko soils are shallow to bedrock. They are generally in the lower areas along sharp slope breaks. Included soils make up 5 to 10 percent of the unit.

Important properties of the Eldon soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. This soil is generally unsuited to cultivated crops because of the severe hazard of erosion. It is moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Droughtiness and erosion are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife, especially small-seed grains, is scarce. Timely plantings of food plots in the less gravelly areas or on adjacent soils that are better suited improve the production and quality of food. Wildlife areas should be protected from grazing and from fire.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and the slope are moderate limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the foundation helps to remove excess water. Large stones should be removed from the building site. Some land grading generally is necessary to modify the slope. Septic tank absorption fields can function adequately if lateral lines are installed across the slope. Increasing the size of the absorption field helps to compensate for the restricted permeability. Backfilling with material that is free of stones also improves the functioning of the field.

The shrink-swell potential, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Providing adequate roadside

ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cut and fill may be necessary because of the slope, or the roads can be designed so that they conform to the natural slope.

The land capability classification is VIe. No woodland ordination symbol is assigned.

35A—Freeburg silt loam, 0 to 2 percent slopes, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, dark grayish brown, friable silt loam

Subsurface layer:
10 to 20 inches, grayish brown, mottled, friable silt loam

Subsoil:
20 to 53 inches, dark yellowish brown, brown, and grayish brown, mottled, firm silty clay loam

Substratum:
53 to 60 inches, mottled grayish brown and dark yellowish brown, firm silt loam

In some places the surface layer is very dark grayish brown. In other places the subsoil contains more clay. Some areas are subject to rare flooding.

Included with this soil in mapping are small areas of Bremer, Dockery, and Moniteau soils. Bremer and Moniteau soils are poorly drained and are in landscape positions similar to those of the Freeburg soil. Dockery soils are not characterized by an increase in clay content with increasing depth. They are in the lower areas. Included soils make up 5 to 10 percent of the unit.

Important properties of the Freeburg soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Low
Seasonal high water table: Perched at a depth of 1.0 to 2.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, wetness and flooding are the major management concerns. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from adjacent areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. Flooding may delay the planting or harvesting of crops in some years, and areas that are plowed in the fall may be subject to scouring.

This soil is moderately suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as switchgrass. The seasonal high water table and the flooding are the main concerns. Varieties that are tolerant of these conditions should be selected for planting. Preparing a seedbed is not difficult, except during wet periods. A surface drainage system helps to remove excess water.

This soil is suited to trees. No major limitations or hazards affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 3A.

35B—Freeburg silt loam, 1 to 4 percent slopes, rarely flooded. This very deep, very gently sloping, somewhat poorly drained soil is on toe slopes and alluvial fans on flood plains along small streams. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsurface layer:
8 to 14 inches, brown, mottled, friable silt loam

Subsoil:
14 to 20 inches, yellowish brown, mottled, firm silt loam
20 to 50 inches, mottled, yellowish brown, grayish brown, and dark grayish brown, firm silty clay loam

Substratum:
50 to 60 inches, grayish brown, mottled, firm silty clay loam

In some areas the surface layer is very dark grayish brown. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Dockery, McGirk, and Moniteau soils. Dockery soils are

not characterized by an increase in clay content with increasing depth. They are in the lower areas. Moniteau and McGirk soils are poorly drained. Moniteau soils are in landscape positions similar to those of the Freeburg soil. McGirk soils are in the higher areas adjacent to the uplands. Included soils make up 5 to 10 percent of the unit.

Important properties of the Freeburg soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Low
Seasonal high water table: Perched at a depth of 1.0 to 2.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, wetness and erosion are the major management concerns. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from adjacent areas. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. Wetness may delay the planting or harvesting of crops in some years.

This soil is moderately suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as switchgrass. The seasonal high water table and erosion are the main concerns. Varieties that are tolerant of these conditions should be selected for planting. Grazing systems should be designed around the seasonal wetness. Preparing a seedbed is not difficult, except during wet periods. A surface drainage system helps to remove excess water.

This soil is well suited to trees. No major limitations or hazards affect timber management.

This soil generally is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIe. The woodland ordination symbol is 3A.

38B2—Glensted silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, poorly drained soil is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The remaining surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to 20 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsoil:
8 to 22 inches, mottled, dark grayish brown, grayish brown, and brown, very firm silty clay
22 to 60 inches, light brownish gray, mottled, firm silty clay and silty clay loam

In some areas the soil has a dense layer in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Clafork soils. These soils are in the higher convex areas. They make up about 5 percent of the unit.

Important properties of the Glensted soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Wetness is also a limitation affecting cultivated crops. It can be reduced by diverting runoff from upslope areas with diversion terraces, shallow surface ditches, and open lateral ditches. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to shallow-rooted legumes. It is moderately suited to the commonly grown legumes, such as ladino clover and alsike clover; to cool-season

grasses, such as tall fescue; and to warm-season grasses, such as little bluestem and indiangrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth.

This soil generally is not used for building site development or onsite waste disposal systems because of the wetness, the shrink-swell potential, and the restricted permeability.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

40C—Goss silt loam, 3 to 8 percent slopes. This very deep, gently sloping and moderately sloping, well drained soil is on the summits and shoulders of ridges in the uplands. Individual areas are irregular in shape and range from 5 to more than 20 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, very dark grayish brown, friable silt loam

Subsurface layer:
3 to 10 inches, brown, friable silt loam

Subsoil:
10 to 28 inches, yellowish red, firm extremely gravelly silty clay loam and silty clay
28 to 47 inches, red, firm extremely gravelly silty clay and clay
47 to 60 inches, red, firm gravelly clay

In some areas bedrock is at a depth of 40 to 60 inches. In places the very dark grayish brown surface layer is thicker.

Included with this soil in mapping are small areas of Bluelick and Wrengart soils. Bluelick soils do not have gravel in the upper 20 to 40 inches. They are along the less sloping areas. Wrengart soils do not have gravel in the upper 40 to 60 inches. Included soils make up 5 to 10 percent of the unit.

Important properties of the Goss soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few of the less sloping areas are used for pasture. This soil is suited to cultivated crops only on a limited basis. It is suited to trees, and several areas support stands of native hardwoods. No major limitations or hazards affect timber management.

This soil is suited to pasture and hay crops. It is moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Droughtiness and erosion during seedbed preparation are the main management concerns. Overgrazing and deep tillage should be avoided. Timely seedbed preparation and preparing the seedbed on the contour help to minimize soil loss.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife, especially small-seed grains, is scarce. Timely plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential, the slope, and large stones are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to remove excess water. The large stones should be removed from the building site. Some land grading generally is necessary to modify the slope. Septic tank absorption fields can function adequately if lateral lines are installed across the slope. Increasing the size of the absorption field helps to compensate for the restricted permeability. Backfilling with material that is free of stones also improves the functioning of the absorption field. Sewage lagoons function adequately if the area can be leveled. Sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

The shrink-swell potential and the potential for frost action limit the use of this soil as a site for local roads and streets. Providing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

40D—Goss silt loam, 8 to 15 percent slopes. This very deep, strongly sloping, well drained soil is on the back slopes of ridges in the uplands. Individual areas

are irregular in shape and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, brown, friable silt loam

Subsurface layer:
3 to 9 inches, brown, friable silt loam

Subsoil:
9 to 14 inches, strong brown, friable gravelly silty clay loam
14 to 60 inches, yellowish red and red, firm very gravelly and extremely gravelly silty clay

In some areas bedrock is at a depth of 40 to 60 inches. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Bluelick, Moko, and Wrengart soils. Bluelick and Wrengart soils do not have gravel in the upper 20 to 40 inches. They are along the less sloping areas. Moko soils are shallow to bedrock. They generally are in the lower areas along sharp slope breaks. Included soils make up 5 to 10 percent of the unit.

Important properties of the Goss soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas of this soil are used as woodland (fig. 9). A few of the less sloping areas are used for pasture. This soil generally is not suited to cultivated crops because of the severe hazard of erosion. It is suited to trees, and several areas support stands of native hardwoods. No major hazards or limitations affect timber management.

This soil is suited to pasture and hay crops. It is moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Droughtiness and erosion are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife, especially small-seed grains, is scarce. Timely plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential, the slope, and large stones are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the foundation helps to remove excess water. The large stones should be removed from the building site. Some land grading generally is necessary to modify the slope. Septic tank absorption fields can function adequately if lateral lines are installed across the slope. Also, increasing the size of the absorption field helps to compensate for the restricted permeability. Backfilling with material that is free of stones also improves the functioning of the absorption field. Sewage lagoons function adequately if the area can be leveled and if the large stones are removed. Sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

The shrink-swell potential, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cut and fill may be necessary because of the slope, or the roads can be designed so that they conform to the natural slope.

The land capability classification is VIe. The woodland ordination symbol is 3A.

40F—Goss gravelly silt loam, 15 to 45 percent slopes, very stony. This very deep, moderately steep to very steep, well drained soil is on the back slopes of ridges in the uplands. Stones cover 0.1 to 3.0 percent of the surface. Individual areas of this soil are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches, dark brown, friable gravelly silt loam

Subsurface layer:
4 to 21 inches, yellowish brown and brown, mottled, friable very gravelly silt loam

Subsoil:
21 to 29 inches, strong brown very gravelly silt loam

Figure 9.—Hardwood forest and woody understory vegetation in an area of Goss silt loam, 8 to 15 percent slopes.

29 to 44 inches, yellowish red and dark red, very firm very gravelly clay
44 to 60 inches, dark red, very firm gravelly clay

In some areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bluelick, Moko, and Wrengart soils. Bluelick and Wrengart soils do not have gravel in the upper 20 to 40 inches. They are along the less sloping areas. Moko soils are shallow to bedrock. They generally are in the lower areas along sharp slope breaks. Included soils make up 5 to 10 percent of the unit.

Important properties of the Goss soil—

Permeability: Moderate
Surface runoff: Rapid and very rapid
Available water capacity: Low
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few of the less sloping areas are used for pasture. This soil generally is unsuited to cultivated crops because of the severe hazard of erosion and the gravelly surface layer. It is best suited to trees, and several areas support stands of native hardwoods. The hazard of erosion, equipment limitations, and seedling mortality are major concerns affecting timber management. Establishing roads and skid trails on the contour and installing water bars help

to control erosion. Because of the gravelly surface layer and the slope, hand planting of seedlings may be necessary in some areas. In some areas it may be necessary to yard the logs uphill to logging roads and skid trails. Reinforcement planting or container-grown stock improves the seedling survival rate.

This soil is suited to pasture in areas that do not have rock fragments on the surface. It is moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Droughtiness, erosion, and stone fragments in the surface layer are the main management concerns. Tillage should be avoided. The soil generally is unsuitable for hay crops because of the slope.

This soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife, especially small-seed grains, is scarce. Timely plantings of food plots in the less cherty included areas improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil is generally not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

41—Grable silt loam, loamy substratum, occasionally flooded. This very deep, nearly level, well drained soil is on natural levees on low flood plains along the Missouri River. It is protected by levees but is subject to flooding for brief periods because of levee breaks or runoff from adjacent upland areas. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 6 inches, very dark grayish brown, very friable silt loam

Substratum:
- 6 to 23 inches, layered grayish brown and dark grayish brown, very friable silt loam
- 23 to 39 inches, layered grayish brown and dark grayish brown, loose fine sand
- 39 to 60 inches, layered grayish brown and dark grayish brown, very friable silt loam

In some areas the surface layer is brown and is loamy fine sand or coarser sand.

Included with this soil in mapping are small areas of Sarpy soils. These soils have more sand throughout than the Grable soil. They are in landscape positions similar to those of the Grable soil. Also included are some areas between the levee and the Missouri River that are subject to frequent flooding. Included areas make up about 10 percent of the unit.

Important properties of the Grable soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and winter wheat. Irrigation may be necessary during dry periods. Center-pivot and traveling gun irrigation systems are the most suitable. The flooding may cause some crop loss. Restricting fall plowing and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to pasture and hay crops. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and switchgrass. The flooding is the main management concern.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

46—Haynie silt loam, occasionally flooded. This very deep, nearly level, moderately well drained soil is on natural levees on low flood plains along the Missouri River. It is protected by levees but is subject to flooding for brief periods because of levee breaks or overflow from local tributaries. Individual areas generally are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 9 inches, very dark grayish brown, friable silt loam

Substratum:
- 9 to 60 inches, layered grayish brown, dark grayish brown, and brown, friable silt loam

In some areas the substratum contains more clay. In other areas the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Grable and Waldron soils. Grable soils have more sand in the substratum than the Haynie soil. They are in landscape positions similar to those of the Haynie soil. Waldron soils have more clay throughout than the Haynie soil. They are in small drainageways and depressions. Also included are some areas between the levee and the Missouri River that are subject to frequent flooding. Included areas make up about 10 percent of the unit.

Important properties of the Haynie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of 3 to 6 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. Flooding may cause some crop loss. Restricting fall plowing and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to pasture and hay crops. It is well suited to most of the commonly grown legumes, such as alfalfa, ladino clover, and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The flooding is the main management concern.

This soil is suited to trees. The frequently flooded areas between the Missouri River and the levee are best suited to woodland. No major limitations or hazards affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 11A.

47—Haynie-Waldron complex, occasionally flooded. This map unit consists of very deep, nearly level soils in areas adjacent to the Missouri River. These areas have an intricate pattern of abandoned channels and low, natural levees. They are protected by levees but are subject to flooding for brief or long periods because of levee breaks or runoff from adjacent upland areas. They are about 60 percent Haynie soil and 30 percent Waldron soil. The Haynie soil is moderately well drained, and the Waldron soil is somewhat poorly drained. Individual areas of these soils are long and narrow and range from 40 to more than 200 acres in size. The two soils occur as areas so small or so intricately mixed that they could not be shown separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers of the Haynie soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, very friable silt loam

Substratum:
9 to 60 inches, layered grayish brown, brown, and dark grayish brown, friable silt loam

Important properties of the Haynie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of 3 to 6 feet

The typical sequence, depth, and composition of the layers of the Waldron soil are as follows—

Surface layer:
0 to 9 inches, very dark gray, friable silty clay loam

Substratum:
9 to 26 inches, layered dark gray and dark grayish brown, mottled, very firm silty clay
26 to 31 inches, layered dark grayish brown and brown, mottled, firm silty clay loam
31 to 43 inches, dark gray, firm silty clay
43 to 60 inches, layered dark grayish brown and dark gray, mottled, firm silty clay loam

Important properties of the Waldron soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of 1.0 to 2.5 feet
Shrink-swell potential: High

Included with these soils in mapping are small areas of the well drained Grable and excessively drained Sarpy soils. Grable and Sarpy soils have more sand throughout than the major soils. They are in the slightly higher areas. Also included are some areas between the levee and the Missouri River that are subject to frequent flooding. Included areas make up about 10 percent of the unit.

Nearly all areas of this unit are used for cultivated crops. These soils are suited to soybeans, corn, winter

wheat, and grain sorghum. Wetness is the major management concern in areas of the Waldron soil in abandoned meanders. Land grading, shallow surface ditches, and open lateral ditches improve drainage. Returning crop residue to the soil or regularly adding other organic material improves tilth, minimizes crusting, and increases the rate of water infiltration. No major limitations or hazards affect the management of cultivated crops in areas of the Haynie soil.

These soils are suited to trees. Most of the included areas between the levee and the river channel are wooded. No major limitations or hazards affect timber management in areas of the Haynie soil. In areas of the Waldron soil, however, seedling mortality and equipment limitations are major concerns. Reinforcement planting or container-grown stock improves the seedling survival rate. The use of equipment should be limited to periods when the soil is dry or frozen.

These soils are unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 11A for the Haynie soil and 11C for the Waldron soil.

48B—Higginsville silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark gray, very friable silt loam

Subsurface layer:
9 to 20 inches, very dark gray, friable silt loam

Subsoil:
20 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the well drained Wakenda soils on the ends of ridges. These soils make up about 5 percent of the unit.

Important properties of the Higginsville soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Some areas are wet and seepy, but properly placed drainage tile helps to overcome the wetness. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. It is moderately suited to alfalfa, orchardgrass, and smooth bromegrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Increasing the size of the absorption field, installing perimeter drains, and mounding or raising the site with suitable fill material improve the functioning of the absorption field. Sewage lagoons can function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited can also be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches,

and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

50C—Bunceton silt loam, 3 to 8 percent slopes. This very deep, gently sloping and moderately sloping, well drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silt loam

Subsoil:

8 to 11 inches, yellowish brown, friable silt loam

11 to 31 inches, dark yellowish brown, firm silty clay loam

31 to 48 inches, dense layer of dark yellowish brown and strong brown, firm, brittle silty clay loam

48 to 60 inches, brown and strong brown, firm extremely gravelly silt loam

In some areas the gravelly layer is above a depth of 40 inches. In other areas the surface layer is brown. In places the lower part of the subsoil has grayish mottles.

Included with this soil in mapping are small areas of Eldon and Clafork soils. Eldon soils are gravelly in the upper part. They are in the steeper areas. Clafork soils are somewhat poorly drained and are in the higher, flatter areas. They have more clay in the subsoil than the Bunceton soil. Included soils make up about 5 percent of the unit.

Important properties of the Bunceton soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops (fig. 10). A few small areas are used for cultivated crops or timber. This soil is suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss. The dense layer in the subsoil may restrict rooting depth and can result in insufficient soil moisture during dry years.

A few areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces and grassed waterways, contour farming, and a conservation cropping system that includes rotations of pasture, hay crops, or wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

50C2—Bunceton silt loam, 3 to 8 percent slopes, eroded. This very deep, gently sloping and moderately sloping, well drained soil commonly is on the summits and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface

Figure 10.—Improved pasture in an area of Bunceton silt loam, 3 to 8 percent slopes.

layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, dark brown, friable silt loam

Subsoil:

8 to 25 inches, dark yellowish brown, firm silty clay loam

25 to 45 inches, dense layer of yellowish brown and dark yellowish brown, very firm, brittle silt loam

45 to 54 inches, dense layer of mottled yellowish brown and grayish brown, firm, brittle extremely gravelly silty clay loam

54 to 60 inches, strong brown, firm extremely gravelly silt loam

In some areas the subsoil is gravelly above a depth of 40 inches. In other areas the surface layer is brown. In places the lower part of the subsoil has grayish brown mottles.

Included with this soil in mapping are small areas of Bluelick, Eldon, and Clafork soils. Bluelick and Eldon soils are in the steeper areas. Eldon soils are gravelly in the upper part. Bluelick and Clafork soils have more clay in the subsoil than the Bunceton soil. Clafork soils are somewhat poorly drained and are in the broader, less sloping areas. Included soils make up about 5 percent of the unit.

Important properties of the Bunceton soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas

are used for pasture and hay crops, and some areas are wooded. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Some areas are suited to terraces, but deep cutting can expose gravel in places. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields.

A few areas are used for pasture and hay crops. This soil is suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to control erosion. The dense layer in the subsoil may restrict rooting depth and can result in insufficient soil moisture during dry years.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent the damage caused by wetness. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

50D2—Bunceton silt loam, 8 to 15 percent slopes, eroded. This very deep, strongly sloping, well drained soil commonly is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 11 inches, dark yellowish brown, firm silty clay loam
11 to 22 inches, brown and strong brown, firm silty clay loam
22 to 41 inches, dense layer of strong brown, firm, brittle silty clay loam
41 to 60 inches, brown and red, firm very gravelly and extremely gravelly silty clay loam

In some areas the subsoil is gravelly above a depth of 40 inches. In other areas the surface layer is brown.

Included with this soil in mapping are small areas of Dameron and Eldon soils. Dameron soils have gravel at a depth of 20 to 40 inches. They are on narrow flood plains below the Bunceton soil. Eldon soils have gravel throughout. They are in landscape positions similar to those of the Bunceton soil. Included soils make up about 5 percent of the unit.

Important properties of the Bunceton soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. A few small areas are used for cultivated crops, and some areas are wooded. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. Controlling erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and

help to ensure good ground cover. The dense layer in the subsoil may restrict rooting depth and can result in insufficient soil moisture during dry years.

This soil is suited to cultivated crops only on a limited basis because of the slope and the hazard of further erosion. The soil is suited to corn, soybeans, grain sorghum, and winter wheat. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Some areas are suited to terraces, but deep cutting can expose gravel in places. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent the damage caused by wetness. Some land grading generally is necessary to modify the slope. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

51C2—Knox silt loam, 3 to 9 percent slopes, eroded. This very deep, gently sloping and moderately sloping, well drained soil commonly is on the summits and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable silt loam

Subsoil:
8 to 48 inches, dark yellowish brown, firm silty clay loam

Substratum:
48 to 60 inches, yellowish brown, firm silt loam

In some areas the subsoil contains more clay and has grayish brown mottles. In other areas the surface layer is brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Pershing soils. These soils are on the lower back slopes. They make up about 5 percent of the unit.

Important properties of the Knox soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops or for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and

orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No serious concerns affect pasture and hay crops. Erosion is a concern when new seedings are being established. Timely seedbed preparation helps to ensure good ground cover.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the foundations helps to remove excess water. Conventional septic tank absorption fields can function adequately if lateral lines are properly installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

52C2—Ladoga silt loam, 3 to 9 percent slopes, eroded. This very deep, moderately well drained, gently sloping and moderately sloping soil is on convex summits and the rounded parts of high terraces. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are generally long and narrow and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsoil:
8 to 23 inches, dark yellowish brown, friable and firm silty clay loam
23 to 36 inches, dark yellowish brown, mottled, firm silty clay loam

Substratum:
36 to 60 inches, yellowish brown, mottled, firm silty clay loam

In some areas the subsoil has less clay. In other areas the lower part of the subsoil and the substratum are not mottled.

Included with this soil in mapping are small areas of Bunceton and Pershing soils. Bunceton soils have a dense layer in the subsoil. They are on convex back slopes below the Ladoga soil. Pershing soils are somewhat poorly drained and are on concave back slopes below the Ladoga soil. Included soils make up about 5 percent of the unit.

Important properties of the Ladoga soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include no-till farming (fig. 11) or a system of conservation tillage that leaves a protective cover of crop residue on the surface, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, winter cover crops, and contour farming. Conservation cropping systems that include pasture and hay crops or winter wheat in the rotation are also effective in controlling erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes surface crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass, orchardgrass, and tall fescue; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture or hay crops. Erosion is a concern when new seedings are established. Timely seedbed preparation helps to ensure good ground cover.

This soil is suited to trees. A few small areas support native hardwoods. No major hazards or limitations affect timber management.

This soil is suited to building site development and onsite waste disposal systems, but the shrink-swell potential and the restricted permeability are limitations

Figure 11.—No-till soybeans in an area of Ladoga silt loam, 3 to 9 percent slopes, eroded.

on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. The soil generally is unsuited to septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the site can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

53—Buckney fine sandy loam, occasionally flooded. This very deep, nearly level, somewhat excessively drained soil commonly is on natural levees on the high flood plain along the Missouri River. It is subject to flooding for brief periods because of levee breaks. Individual areas are long and narrow and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, very dark grayish brown, friable fine sandy loam

Subsurface layer:
10 to 15 inches, dark brown, friable fine sandy loam

Substratum:
15 to 60 inches, yellowish brown and brown, loose fine sand

In some areas the surface layer contains more clay. In other areas the substratum is very fine sandy loam.

Included with this soil in mapping are small areas of the well drained Eudora and somewhat poorly drained Leta soils. Eudora soils are in landscape positions similar to those of the Buckney soil. Leta soils are in the lower areas. Included soils make up about 10 percent of the unit.

Important properties of the Buckney soil—

Permeability: Moderately rapid
Surface runoff: Slow
Available water capacity: Low
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet

Most areas are used for cultivated crops. This soil is suited to grain sorghum and winter wheat. Supplemental irrigation is necessary during dry periods. Flooding may cause some crop loss. Restricting fall plowing and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to grasses and legumes for pasture and hay. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and switchgrass. Droughtiness and flooding are the main management concerns.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

54A—Leslie silt loam, terrace, 0 to 2 percent slopes. This very deep, nearly level, poorly drained soil is on high stream terraces. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Subsurface layer:
9 to 14 inches, very dark gray, friable silt loam
14 to 22 inches, dark grayish brown, friable silt loam

Subsoil:
22 to 60 inches, dark grayish brown, yellowish brown, and grayish brown, mottled, firm silty clay loam and silty clay

In some areas the very dark grayish brown surface layer and subsurface layer are less than 10 inches thick. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the well drained Dameron soils. These soils have gravel at a depth of 24 to 40 inches. They are adjacent to the drainageways. They make up about 5 percent of the unit.

Important properties of the Leslie soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at the surface to 1.5 feet below the surface
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If the soil is used for row crops, wetness and soil blowing are the main management concerns. In places where the soil is left without a cover of vegetation for long periods, soil blowing is a serious concern. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Restricting fall plowing and using a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to pasture and hay crops. It is moderately suited to wetness-tolerant, shallow-rooted legumes, such as ladino clover and alsike clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as switchgrass. Wetness is the main concern. Maintaining stands of desirable species is difficult in depressional areas. A surface drainage system may be needed.

This soil generally is not used for building site development or onsite waste disposal systems because of the wetness and the shrink-swell potential. Alternate sites that are better suited are generally available.

The land capability classification is IIw. No woodland ordination symbol is assigned.

54B—Leslie silt loam, 1 to 3 percent slopes. This very deep, very gently sloping, somewhat poorly drained soil is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches, very dark gray, friable silt loam

Subsurface layer:
11 to 16 inches, dark grayish brown, mottled, friable silt loam

Subsoil:
16 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam and silty clay

In some places the very dark gray surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer at a depth of 20 to 40 inches. They are on ridge ends. They make up about 5 percent of the unit.

Important properties of the Leslie soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1 to 2 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, contour farming, winter cover crops, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as timothy and tall fescue; and to warm-season grasses, such as big bluestem and indiangrass. The species that can withstand wetness grow best. Erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

54B2—Leslie silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil commonly is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable silt loam

Subsurface layer:
6 to 10 inches, very dark grayish brown, friable silt loam

Subsoil:
10 to 39 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

39 to 60 inches, gray, firm silty clay loam

In some places the very dark grayish brown surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Clafork soils. These soils have a dense layer at a depth of 20 to 40 inches. They are on the lower back slopes. They make up about 5 percent of the unit.

Important properties of the Leslie soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1 to 2 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, terraces combined with grassed waterways or tile outlets, contour farming, winter cover crops, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as timothy and tall fescue; and to warm-season grasses, such as big bluestem and indiangrass. Species that can withstand wetness grow best. Erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately, but sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

56—Leta silty clay loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on natural levees on the high flood plain along the Missouri River. The soil is protected by levees, but it is subject to flooding for brief periods because of levee breaks. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches, very dark grayish brown, firm silty clay loam

Subsurface layer:
12 to 18 inches, very dark grayish brown, firm silty clay

Subsoil:
18 to 26 inches, dark grayish brown, very firm silty clay

Substratum:
26 to 60 inches, layered grayish brown and brown, very friable silt loam

In some areas the very dark grayish brown surface layer is less than 10 inches thick. In other areas the surface layer is silt loam overwash.

Included with this soil in mapping are small areas of Darwin and Waldron soils. Darwin soils have more clay in the lower part than the Leta soil. They are in the lower areas. Waldron soils have more clay in the substratum than the Leta soil. They are in the lower areas adjacent to the Leta soil. Included soils make up about 10 percent of the unit.

Important properties of the Leta soil—

Permeability: Slow in the upper clayey part, moderate in the lower silty part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate

Seasonal high water table: At a depth of 1 to 3 feet
Shrink-swell potential: High in the upper clayey part, low in the lower loamy part

Most areas are used for row crops. This soil is suited to soybeans, grain sorghum, corn, and winter wheat. Wetness and flooding are the main management concerns. In places, surface runoff is very slow and the surface generally is covered with water after hard rains or as a result of runoff from adjacent areas. Land grading, shallow surface ditches, and open lateral ditches help to remove excess surface water. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees, but equipment limitations, the windthrow hazard, and seedling mortality are management concerns. Planting or harvesting when the soil is dry or frozen helps to overcome the equipment limitations. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Reinforcement plantings or container-grown seedlings may be needed to increase the seedling survival rate.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding and the wetness.

The land capability classification is IIw. The woodland ordination symbol is 7C.

60F—Lindley silt loam, 14 to 35 percent slopes. This very deep, moderately steep and steep, well drained soil is on the back slopes of ridges in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, dark grayish brown, friable silt loam

Subsurface layer:
5 to 12 inches, brown, friable silt loam

Subsoil:
12 to 23 inches, yellowish brown, firm silt loam
23 to 33 inches, strong brown, firm clay loam
33 to 60 inches, strong brown and yellowish red, mottled, firm loam

In some areas the subsoil and the substratum do not have mottles. In other areas the soil contains less sand throughout.

Included with this soil in mapping are small areas of Menfro and Weller soils. These soils do not have glacial sand or gravel. Menfro soils are in the less sloping convex areas. Weller soils are in the wider, less sloping and less convex areas. Included soils make up about 10 percent of the unit.

Important properties of the Lindley soil—

Permeability: Moderately slow
Surface runoff: Rapid and very rapid
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 3.5 to 5.0 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few small areas are used as pasture. This soil is unsuited to cultivated crops because of the slope and the severe hazard of erosion. It is best suited to trees, and many areas support stands of native hardwoods. The erosion hazard and equipment limitations are the main concerns affecting timber management. Establishing roads and skid trails on the contour helps to overcome the slope. Constructing water bars helps to control erosion. Seeding may be needed in disturbed areas after harvesting is completed. In some steeper areas it may be necessary to yard logs uphill to roads and trails. Hand planting may also be needed in these areas.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as switchgrass. Erosion control is the main management concern. Maintaining a good ground cover improves production. Nurse crops can be used to control erosion when new seedings are established. Timely tillage on the contour and a quickly established ground cover help to minimize soil loss. No-till seeding also helps to control erosion. Measures that maintain fertility and that control brush are necessary. The soil generally is unsuitable for hay crops because of the slope.

This soil is suited to woodland wildlife habitat. The soil generally provides adequate cover, but forage for wildlife, especially legumes and seeds, is scarce. Timely planting of food plots in the less sloping areas improves the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope and wetness.

The land capability classification is VIe. The woodland ordination symbol is 3R.

64B—McGirk silt loam, 2 to 5 percent slopes. This very deep, gently sloping, poorly drained soil is on the

foot slopes of ridges in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, brown, very friable silt loam

Subsurface layer:
7 to 12 inches, light brownish gray, friable silt loam

Subsoil:
12 to 17 inches, light brownish gray, mottled, friable silt loam
17 to 32 inches, grayish brown, mottled, firm silty clay loam and silty clay
32 to 60 inches, light brownish gray, mottled, firm silty clay loam

In some areas the surface layer is very dark gray. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the moderately well drained Weller soils and the somewhat poorly drained Dockery and Freeburg soils. Weller soils are in the higher convex areas. Dockery and Freeburg soils are in the lower areas on the flood plain. Included soils make up about 5 percent of the unit.

Important properties of the McGirk soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 0.5 foot to 2.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture, hay crops, or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Wetness is also a limitation affecting cultivated crops. It can be reduced by diverting runoff from the uplands with diversion terraces and shallow surface ditches. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to shallow-rooted legumes and grasses. It is moderately suited to the commonly grown legumes, such as ladino clover and alsike clover; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as little bluestem and indiangrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are the main management concerns. Because of the wetness, the use of equipment should be limited to periods when the surface is dry or frozen. Ridging the soil and planting on the ridges improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil generally is not used for building site development or onsite waste disposal systems because of the restricted permeability and the wetness.

The land capability classification is IIe. The woodland ordination symbol is 3W.

66C—Menfro silt loam, 3 to 9 percent slopes. This very deep, gently sloping and moderately sloping, well drained soil is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsurface layer:
8 to 15 inches, brown, friable silt loam

Subsoil:
15 to 42 inches, brown and dark yellowish brown, firm silty clay loam

Substratum:
42 to 60 inches, dark yellowish brown, friable silt loam

In some areas the subsoil contains more clay. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of the moderately well drained Weller soils, which have more clay in the subsoil than the Menfro soil. These soils are in drainageways and on the lower back slopes. They make up about 5 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. A few areas are used for cultivated crops. Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay crops. Erosion is a concern when new seedings are established. Timely seedbed preparation helps to ensure good ground cover.

This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suited to building site development and onsite waste disposal systems. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to remove excess water. Conventional septic tank absorption fields function adequately in areas of this soil if the lateral lines are installed across the slope. Sewage lagoons also function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent seepage.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

66C2—Menfro silt loam, 3 to 9 percent slopes, eroded. This very deep, gently sloping and moderately sloping, well drained soil commonly is on the summits and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, dark brown, friable silt loam

Subsoil:
6 to 49 inches, dark yellowish brown, firm silty clay loam and silt loam

Substratum:
49 to 60 inches, yellowish brown, friable silt loam

In some areas the subsoil contains more clay. In other areas the surface layer is dark brown.

Included with this soil in mapping are small areas of the moderately well drained Weller soils, which have more clay in the subsoil than the Menfro soil. These soils are in drainageways and on the lower back slopes. They make up about 5 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops or for pasture and hay. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility,

minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay. Erosion is a management concern when new seedings are established. Timely seedbed preparation helps to ensure good ground cover.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suited to building site development and onsite waste disposal systems. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to remove excess water. Conventional septic tank absorption fields function adequately if the lateral lines are installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent seepage.

Low strength, the shrink-swell potential, wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Constructing adequate roadside ditches and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

66D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, well drained soil is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 39 inches, dark yellowish brown, firm silty clay loam

Substratum:
39 to 60 inches, dark yellowish brown, friable silt loam

In some areas the surface layer is dark brown. In other areas the surface layer is silty clay loam as a result of severe erosion.

Included with this soil in mapping are small areas of the moderately well drained Weller soils, which have more clay in the subsoil than the Menfro soil. These soils are in heads of drainageways and on the lower back slopes. They make up about 5 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for hay, pasture, or cultivated crops. A few small areas are wooded. Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover. Measures that maintain fertility and that control brush are necessary.

This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets and grade-stabilization structures, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suited to building site development and onsite waste disposal systems. The slope and the

shrink-swell potential are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to remove excess water. Conventional septic tank absorption fields function adequately in areas of this soil if lateral lines are installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the berms and bottom of the lagoon with slowly permeable material helps to prevent seepage.

Low strength, the shrink-swell potential, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action. Some cut and fill may be necessary because of the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

66F—Menfro silt loam, 14 to 35 percent slopes. This very deep, moderately steep and steep, well drained soil is on dissected back slopes of ridges in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, brown, friable silt loam

Subsurface layer:
5 to 13 inches, yellowish brown, friable silt loam

Subsoil:
13 to 40 inches, dark yellowish brown, firm silty clay loam

Substratum:
40 to 60 inches, yellowish brown, firm silt loam

In some areas the surface layer is dark brown. In other areas grayish brown mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of Goss and Lindley soils. These soils are on the lower back slopes. Goss soils are gravelly throughout. Lindley soils have more sand than the Menfro soil and have gray mottles in the subsoil. Included soils make up about 10 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Rapid and very rapid
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few areas are used for pasture and hay crops. This soil generally is unsuited to cultivated crops because of the slope and the severe hazard of erosion. It should be tilled only when necessary for reseeding pastures.

This soil is suited to trees. Because of the slope, equipment limitations and the hazard of erosion are concerns. Establishing roads and skid trails on the contour and installing water bars help to control erosion. Seeding may be needed in disturbed areas after harvesting is completed. In some steeper areas it may be necessary to yard logs uphill to logging roads and skid trails.

This soil is suited to pasture. It is well suited to most of the commonly grown legumes, such as red clover and alfalfa; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as switchgrass and Caucasian bluestem. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation and preparing the seedbed on the contour promote rapid growth and help to ensure good ground cover. Measures that maintain fertility and that control brush are needed.

This soil is suited to woodland wildlife habitat. The soil provides adequate cover, but forage for wildlife, especially legumes and seeds, is scarce. Timely plantings of food plots in the less sloping included areas improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

67C2—Menfro silt loam, karst, 3 to 9 percent slopes, eroded. This very deep, gently sloping and moderately sloping, well drained soil is on the summits of ridges in karst areas on uplands. Sinkholes and sinkhole ponds are common. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil

are long and narrow and range from 50 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, brown, friable silt loam

Subsoil:
8 to 40 inches, dark yellowish brown, firm silty clay loam

Substratum:
40 to 60 inches, dark yellowish brown, friable silt loam

In some areas grayish brown mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the moderately well drained Weller soils, which have more clay in the subsoil than the Menfro soil. These soils are in sinkholes and drainageways. They make up about 5 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At a depth of more than 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, and a conservation cropping system that includes rotations of pasture, hay, or wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay. Erosion is a concern when new seedings are established. Timely seedbed preparation helps to ensure good ground cover.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil generally is not used for building site development or onsite waste disposal systems because of the hazard of sinkhole collapse and the possible contamination of ground water.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

70C—Moko-Rock outcrop complex, 3 to 8 percent slopes. This unit consists of the shallow, moderately sloping, well drained Moko soil and areas of Rock outcrop. It is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 20 acres in size. They are about 70 percent Moko soil and 20 percent Rock outcrop. The Moko soil and the Rock outcrop occur as areas so small or so intricately mixed that they could not be shown separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers of the Moko soil are as follows—

Surface layer:
0 to 2 inches, very dark grayish brown, friable very flaggy silty clay loam

Subsurface layer:
2 to 11 inches, very dark grayish brown, firm very flaggy silty clay loam

Bedrock:
11 inches, hard limestone

In some places the depth to bedrock is more than 20 inches.

Included in mapping are small areas of the very deep Eldon and Goss soils. These soils are in landscape positions similar to those of the Moko soil. They make up about 10 percent of the unit.

Important properties of the Moko soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very low
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet

Nearly all areas of the Moko soil are used as woodland or for wildlife habitat. This soil is suited to eastern redcedar. The hazard of erosion, equipment

limitations, seedling mortality, and the windthrow hazard are the major management concerns. Planting seedlings by hand and planting container-grown stock may be needed to reduce the seedling mortality rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

The Moko soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife is scarce. Plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This unit generally is not used for building site development or onsite waste disposal systems because of the shallow depth to bedrock.

The land capability classification of the Moko soil is VIs. The woodland ordination symbol is 2X.

70F—Moko-Rock outcrop complex, 8 to 45 percent slopes. This unit consists of the shallow, strongly sloping to very steep, well drained Moko soil and intermingled areas of Rock outcrop on the back slopes of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 20 acres in size. They are about 70 percent Moko soil and 20 percent Rock outcrop. The Moko soil and the Rock outcrop occur as areas so intricately mixed or so small that they could not be shown separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers of the Moko soil are as follows—

Surface layer:
0 to 3 inches, black, friable very flaggy loam

Subsurface layer:
3 to 9 inches, very dark gray, firm very flaggy silt loam

Bedrock:
9 inches, hard bedrock

In some places the depth to bedrock is more than 20 inches.

Included in mapping are small areas of the very deep Eldon and Goss soils. These soils are in landscape positions similar to those of the Moko soil. They make up about 10 percent of the unit.

Important properties of the Moko soil—

Permeability: Moderate
Surface runoff: Rapid and very rapid
Available water capacity: Very low
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet

Nearly all areas of the Moko soil are wooded and are used as woodland or for wildlife habitat. The hazard of erosion, equipment limitations, seedling mortality, and the windthrow hazard are major management concerns. Because of low production, commercial timber management for hardwoods generally is not practical. This soil is best suited to eastern redcedar (fig. 12). Because of the slope, the use of equipment may be hazardous. Establishing roads and skid trails on the contour helps to overcome the slope. In very steep areas it may be necessary to yard the logs uphill to logging roads or skid trails. Eastern redcedar generally regenerates well.

The Moko soil is suited to the development of habitat for woodland wildlife. The soil provides adequate cover, but forage for wildlife is scarce. Plantings of food plots improve the production and quality of food. Food plots can be planted at the edge of the woodland, in other fringe areas, or on adjacent soils that are better suited. Wildlife areas should be protected from grazing and from fire.

This unit generally is not used for building site development or onsite waste disposal systems because of the slope and the shallow depth to bedrock.

The land capability classification of the Moko soil is VIIs. The woodland ordination symbol is 2R.

72—Moniteau silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 10 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, grayish brown, friable silt loam

Subsurface layer:
10 to 19 inches, mottled grayish brown and light brownish gray, friable silt loam

Subsoil:
19 to 60 inches, grayish brown, gray, dark yellowish brown, and dark gray, firm silty clay loam

In some areas the surface layer is very dark gray. In other areas the upper part of the subsoil is browner.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery soils. These soils are not characterized by an increase in clay content with increasing depth. They are on low flood plains along small streams. Also included are a few areas that

Figure 12.—A stand of eastern redcedar and warm-season grasses in an area of Moko-Rock outcrop complex, 8 to 45 percent slopes.

are subject to frequent flooding. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Moniteau soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: At the surface to 1 foot below the surface
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, wetness and flooding are the major concerns. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from the uplands. Spring flooding may delay tillage in some years, and areas that are plowed in the fall may be susceptible to scouring. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as red clover, ladino clover, and lespedeza; to cool-season grasses, such as timothy and tall fescue; and to warm-season grasses, such as switchgrass. The seasonal high water table is the main management concern. Varieties that are tolerant of wetness should be selected for planting. A good seedbed can be easily prepared. A drainage system is beneficial for deep-rooted species.

This soil is suited to wetness-tolerant trees. Equipment limitations, seedling mortality, and the windthrow hazard are concerns affecting timber management. The use of equipment should be limited to periods when the soil is dry or frozen. Ridging the soil and planting on the ridges improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

75—Shannondale silt loam, rarely flooded. This very deep, nearly level, moderately well drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 10 to 75 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark gray, friable silt loam

Subsurface layer:
9 to 19 inches, very dark gray, friable silt loam

Subsoil:
19 to 24 inches, very dark grayish brown, friable silty clay loam
24 to 60 inches, dark grayish brown, mottled, firm silty clay loam

In some areas the surface layer is dark grayish brown. In other areas the upper part of the subsoil is browner.

Included with this soil in mapping are small areas of the poorly drained Bremer and somewhat poorly drained Speed soils. These soils are in the lower areas. Bremer soils have more clay in the subsoil than the Shannondale soil. Speed soils have a leached subsurface layer. Also included are a few areas that are subject to occasional flooding. Included areas make up about 10 percent of the unit.

Important properties of the Shannondale soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn (fig. 13), soybeans, grain sorghum, and winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay.

This soil generally is unsuited to building site development and onsite waste disposal systems because of the flooding and wetness.

The land capability classification is I. No woodland ordination symbol is assigned.

76—Motark silt loam, occasionally flooded. This very deep, nearly level, moderately well drained soil generally is on alluvial fans on the flood plain along the Missouri River. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Substratum:
8 to 27 inches, dark brown, friable silt loam
27 to 60 inches, layered dark grayish brown and grayish brown, mottled, firm silt loam

In places the substratum contains more clay and free carbonates.

Included with this soil in mapping are small areas of the very poorly drained Darwin soils. These soils are in the lower areas. They make up about 5 percent of the unit.

Important properties of the Motark soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderately low
Seasonal high water table: At a depth of 2.5 to 4.0 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and grain sorghum. If cultivated crops are grown, spring flooding may delay tillage in some years.

This soil is suited to hay and pasture crops. It is well suited to most of the commonly grown legumes, such as red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The flooding is the main management concern. Grazing management

Figure 13.—Corn in an area of Shannondale silt loam, rarely flooded.

should be designed around possible periods of flooding.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 9A.

80B—Pershing silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:

8 to 14 inches, dark grayish brown, mottled, friable silt loam

Subsoil:

14 to 20 inches, mottled, dark grayish brown and brown, friable silt loam

20 to 27 inches, mottled, dark grayish brown and yellowish brown, firm silty clay loam

27 to 36 inches, mottled, dark grayish brown, yellowish brown, and dark yellowish brown, firm silty clay

36 to 60 inches, mottled, grayish brown, yellowish brown, and dark yellowish brown, firm silty clay loam

In some areas the soil has a dense layer in the subsoil. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Leslie soils and the moderately well drained Weller soils. Leslie soils have a thicker dark surface layer than the Pershing soil. They are on the broader summits. Weller soils are on the lower back slopes. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Pershing soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major management concerns. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

80B2—Pershing silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 7 inches, very dark grayish brown, friable silt loam

Subsoil:

7 to 12 inches, brown, mottled, firm silty clay loam
12 to 28 inches, mottled, brown and dark grayish brown, firm silty clay
28 to 38 inches, grayish brown, mottled, firm silty clay loam
38 to 51 inches, light brownish gray, mottled, firm silty clay loam
51 to 60 inches, grayish brown, mottled, firm silt loam

In some areas the soil has a dense layer in the subsoil. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Leslie and Winfield soils. Leslie soils have a thicker dark surface layer than the Pershing soil. They are in landscape positions similar to those of the Pershing soil. Winfield soils are moderately well drained and are

on the steeper slopes below the Pershing soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Pershing soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major management concerns. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

80C2—Pershing silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsoil:
7 to 24 inches, mottled yellowish brown and grayish brown, firm silty clay loam
24 to 34 inches, grayish brown, mottled, firm silty clay loam
34 to 42 inches, light brownish gray, mottled, firm silty clay loam

Substratum:
42 to 60 inches, light brownish gray, mottled, firm silty clay loam

In some areas the surface layer is brown. In other areas the dark surface layer is more than 10 inches thick. In places the soil has a dense layer in the subsoil.

Included with this soil in mapping are small areas of the well drained Knox soils. These soils are in convex areas. They make up about 5 percent of the unit.

Important properties of the Pershing soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 2 to 4 feet

Shrink-swell potential: High

Most areas are used for cultivated crops or for pasture and hay crops. A few small areas are wooded. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

82—Sarpy fine sand, occasionally flooded. This very deep, nearly level, excessively drained soil is on splays on the flood plain along the Missouri River. It is subject to flooding for brief or long periods. Individual areas are long and narrow and range from about 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, brown, loose fine sand

Substratum:
6 to 20 inches, layered brown and grayish brown, loose fine sand
20 to 60 inches, pale brown, loose fine sand

In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Grable and Haynie soils. These soils have less sand than the Sarpy soil. They are in the slightly lower positions on the landscape. They make up about 5 percent of the unit.

Important properties of the Sarpy soil—

Permeability: Rapid
Surface runoff: Slow
Available water capacity: Low
Organic matter content: Low
Seasonal high water table: At a depth of more than 6 feet

Most areas are used for winter wheat or row crops. Because of the hazard of soil blowing, the low available water capacity, and the low content of organic matter, this soil is not well suited to cultivated crops. Restricting fall plowing and using no-till farming or a system of conservation tillage that leaves a protective cover of crop residue on the surface help to control soil blowing. Supplemental irrigation can improve crop yields. Grain sorghum and alfalfa respond well to irrigation in areas of this soil.

Frequent irrigation helps to supply adequate water for economical yields. Frequent, light applications of water and nutrients help to control soil blowing, minimize the deep percolation of nutrients, and maintain an adequate supply of available water. The content of organic matter can be increased by returning crop residue to the soil or regularly adding other organic material.

This soil is suited to trees. Seedling mortality is the main management concern. Reinforcement plantings or

container-grown stock may be necessary to increase the seedling survival rate.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IVs. The woodland ordination symbol is 8S.

86—Speed silt loam, 0 to 2 percent slopes, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark gray, friable silt loam

Subsurface layer:

8 to 14 inches, very dark gray, friable silt loam

14 to 27 inches, dark grayish brown and grayish brown, mottled, friable silt loam

Subsoil:

27 to 60 inches, dark grayish brown, mottled, firm silt loam

In some places the very dark gray surface layer is less than 10 inches thick. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Bremer, Dockery, and Moniteau soils. Bremer and Moniteau soils are in landscape positions similar to those of the Speed soil. Bremer soils do not have a leached subsurface horizon. Moniteau soils have a lighter colored surface layer than the Speed soil. Dockery soils are not characterized by an increase in clay content with increasing depth. They are on the flood plains along small streams. Also included are some areas that are subject to frequent flooding. Included areas make up about 10 percent of the unit.

Important properties of the Speed soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At a depth of 1.0 to 2.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, wetness and flooding are the major concerns. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Diversion terraces may be needed to intercept runoff from adjacent areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The flooding may delay planting or harvesting in some years.

This soil is well suited to the commonly grown legumes, such as red clover and ladino clover; to cool-season grasses, such as timothy and tall fescue; and to warm-season grasses, such as switchgrass. The wetness is the main management concern. Species that are tolerant of wetness should be selected for planting. A seedbed can be easily prepared, except during wet periods. Grazing systems should be designed around possible periods of flooding. A surface drainage system helps to remove excess water.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

87A—Speed silt loam, 0 to 3 percent slopes, rarely flooded. This very deep, nearly level and gently sloping, somewhat poorly drained soil commonly is on alluvial fans on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 10 inches, very dark grayish brown, friable silt loam

Subsurface layer:

10 to 19 inches, very dark gray, friable silt loam

19 to 33 inches, dark grayish brown, mottled, friable silt loam

Subsoil:

33 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Chauncey, Clafork, and Dameron soils. Chauncey soils are poorly drained and are in landscape positions similar to those of the Speed soil. Clafork soils have more clay in the subsoil than the Speed soil. They are in the steeper areas above the Speed soil. Dameron soils have a layer of gravel at a depth of 20 to 40 inches. They are on small flood plains below the Speed soil. Also included are some areas that are subject to occasional flooding. Included areas make up 5 to 10 percent of the unit.

Important properties of the Speed soil—

Permeability: Moderate

Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At a depth of 1.0 to 2.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, wetness and flooding are the major concerns. Diversion terraces may be needed to intercept runoff from adjacent areas. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. The wetness may delay planting or harvesting in some years.

This soil is well suited to the commonly grown legumes, such as red clover and ladino clover; to cool-season grasses, such as timothy and tall fescue; and to warm-season grasses, such as switchgrass. Wetness is the main management concern. Species that are tolerant of wetness should be selected for planting. A seedbed can be easily prepared, except during wet periods. A drainage system is beneficial for deep-rooted species.

This soil generally is not used for building site development or onsite waste disposal systems because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

88—Sturkie silt loam, frequently flooded. This very deep, nearly level, well drained soil is on low flood plains along small streams. It is subject to flooding for brief periods. Individual areas are long and narrow and range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, very dark grayish brown, friable silt loam

Subsurface layer:
10 to 30 inches, very dark grayish brown, friable silt loam

Subsoil:
30 to 50 inches, dark brown, friable silt loam

Substratum:
50 to 60 inches, dark brown, friable silt loam

In some areas grayish brown mottles are in the lower part of the subsoil. In places the soil contains less clay throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery soils. These soils are in the lower areas below the Sturkie soil. They make up about 5 percent of the unit.

Important properties of the Sturkie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At a depth of more than 6 feet

Most areas of this soil are used for cultivated crops or for pasture. A few areas are wooded. Flooding may delay spring tillage. Areas that are plowed in the fall may be subject to scouring during periods of flooding. Open lateral ditches, shallow surface ditches, and land grading help to remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to hay and pasture crops. It is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The flooding is the main management concern. Grazing management should be designed around possible periods of flooding.

This soil is suited to trees. Except for the flooding, which affects the use of equipment, no major limitations or hazards affect timber management.

This soil is unsuited to building site development and onsite waste disposal systems because of the frequent flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

90B—Wakenda silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil commonly is on convex summits of ridges in the uplands. Individual areas are long and moderately wide and range from 5 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 10 inches, very dark grayish brown, friable silt loam

Subsurface layer:
10 to 19 inches, very dark grayish brown, friable silt loam

Subsoil:

19 to 26 inches, brown, firm silt loam and silty clay loam

26 to 41 inches, brown, mottled, firm silty clay loam

41 to 45 inches, mottled, yellowish brown and grayish brown, firm silty clay loam

Substratum:

45 to 60 inches, mottled, brown and grayish brown, firm silty clay loam

In some areas the very dark grayish brown surface layer is more than 24 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Arisburg and Higginsville soils. Arisburg soils are on back slopes below the Wakenda soil. Higginsville soils are in the flatter areas. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Wakenda soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay. Erosion is a management concern when new seedings are established. Timely seedbed preparation and a quickly established ground cover help to minimize soil loss.

This soil is suited to building site development and onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is suitable for conventional septic tank absorption fields, but the wetness is a limitation. Properly installing perimeter drains around the absorption field and mounding or raising the site with suitable fill material help to lower the water table and improve the functioning of the absorption field. Sewage lagoons function adequately if the area can be leveled. Also, sealing the berms and bottom of the lagoon with slowly permeable material helps to prevent seepage.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

90C2—Wakenda silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer. Individual areas of this soil are irregular in shape and range from 5 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 10 inches, very dark grayish brown, friable silt loam

Subsoil:

10 to 25 inches, brown, firm silty clay loam

25 to 43 inches, dark yellowish brown and yellowish brown, mottled, firm silty clay loam

Substratum:

43 to 60 inches, mottled, grayish brown and brown, firm silt loam

In some places the very dark grayish brown surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of the moderately well drained Winfield and somewhat poorly drained Higginsville soils. Winfield soils have a lighter colored surface layer than the Wakenda soil.

They are on the ends of ridges below the Wakenda soil. Higginsville soils are along drainageways. Included soils make up about 5 percent of the unit.

Important properties of the Wakenda soil—

Permeability: Moderate
Surface runoff: Moderate
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for hay and pasture crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces and grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem, indiangrass, and switchgrass. No major limitations affect pasture and hay. Erosion is a management concern when new seedings are established. Timely seedbed preparation and a quickly established ground cover help to minimize soil loss.

This soil is suited to building site development and onsite waste disposal systems, but the shrink-swell potential, wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. The soil is suitable for conventional septic tank absorption fields, but the wetness and the slope are limitations. Properly installing perimeter drains around the absorption field and mounding or raising the site with suitable fill material help to lower the water table and improve the functioning of the absorption field. Lateral lines should be installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the berms and bottom of the lagoon with slowly permeable material helps to prevent seepage.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

92—Waldron silty clay loam, loamy substratum, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is in abandoned channels on the low flood plain along the Missouri River. The soil is protected by levees but is subject to flooding for brief periods because of levee breaks. Individual areas are long and narrow and range from 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark gray, friable silty clay loam

Substratum:
9 to 21 inches, layered dark grayish brown and very dark gray, mottled, firm silty clay loam
21 to 37 inches, very dark gray, mottled, firm silty clay loam
37 to 48 inches, layered dark grayish brown and very dark gray, mottled, firm silty clay loam
48 to 60 inches, layered dark grayish brown and very dark gray, mottled, firm silt loam

In some places the substratum contains less clay and more sand. Some areas are poorly drained. In places the surface layer is silty clay.

Included with this soil in mapping are small areas of Haynie and Leta soils. Haynie soils are silty throughout. They are in the higher, rounded areas. Leta soils have silty clay over loamy material. They are in the higher areas. Included soils make up about 10 percent of the unit.

Important properties of the Waldron soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At a depth of 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few small areas are wooded. This soil is suited to corn, soybeans, and winter wheat. Wetness is the major management concern. Open lateral ditches, shallow surface ditches, and land grading help to remove excess water. The flooding may delay planting. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations and seedling mortality are major concerns affecting timber management. The use of equipment should be limited to periods when the surface is dry or frozen. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 11C.

93B—Cotton silt loam, 2 to 5 percent slopes. This very deep, gently sloping, moderately well drained soil commonly is on the summits of ridges in the uplands. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsurface layer:
8 to 14 inches, pale brown, mottled, friable silt loam

Subsoil:
14 to 19 inches, yellowish brown, mottled, firm silt loam
19 to 33 inches, mottled, dark grayish brown, dark yellowish brown, and yellowish red, very firm and firm silty clay
33 to 54 inches, dense layer of dark yellowish brown and yellowish brown, mottled, very firm, brittle silt loam
54 to 60 inches, dense layer of mottled, yellowish brown, grayish brown, and dark yellowish brown, firm, brittle very gravelly silt loam

In some areas the surface layer is very dark grayish brown. In other areas the subsoil has a larger increase in clay content.

Included with this soil in mapping are small areas of the somewhat poorly drained Crestmeade and Wrengart soils. Crestmeade soils are in the flatter areas. Wrengart soils have less clay in the subsoil than the Cotton soil. They are in rounded areas. Included soils make up about 5 percent of the unit.

Important properties of the Cotton soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops (fig. 14). This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Deep-rooted legumes are generally not suitable because of wetness and the restricted rooting depth. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the

Figure 14.—Alfalfa being cut for hay in an area of Cotton silt loam, 2 to 5 percent slopes.

wetness. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and sides of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

93B2—Cotton silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, moderately well drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 7 inches, brown, friable silt loam

Subsoil:

7 to 19 inches, yellowish brown and brown, mottled, firm silty clay loam and silty clay

19 to 25 inches, mottled, brown and grayish brown, firm silty clay loam
25 to 44 inches, dense layer of mottled, dark yellowish brown and grayish brown, firm, brittle silt loam
44 to 54 inches, dense layer of mottled, yellowish brown and grayish brown, firm, brittle silt loam
54 to 60 inches, dense layer of light brownish gray, mottled, firm, brittle extremely gravelly silt loam

In some areas the soil does not have dense layers in the subsoil. In other areas the surface layer is very dark grayish brown. In places the surface layer is silty clay.

Included with this soil in mapping are small areas of Wrengart and Winfield soils. These soils do not have grayish brown mottles in the upper part of the subsoil. They are in convex areas. They make up about 5 percent of the unit.

Important properties of the Cotton soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Deep-rooted legumes are generally not suitable because of wetness and the restricted rooting depth. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil generally is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and sides of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

93C2—Cotton silt loam, 5 to 8 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, brown, friable silt loam

Subsoil:
6 to 26 inches, yellowish brown and mottled

yellowish brown and grayish brown, firm silty clay loam and silty clay
26 to 47 inches, dense layer of dark grayish brown, grayish brown, and brown, mottled, very firm, brittle silt loam
47 to 60 inches, dense layer of mottled, grayish brown and yellowish brown, firm, brittle extremely gravelly silt loam

In some areas the soil does not have a dense layer. In other areas the subsoil contains less clay. In places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Wrengart soils and the well drained Goss soils. Goss soils are on the steeper slopes below the Cotton soil. Wrengart soils have less clay in the subsoil than the Cotton soil. They are in the more convex areas. Included soils make up about 5 percent of the unit.

Important properties of the Cotton soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Most areas are suited to terraces, but deep cutting can expose gravel in places. In some areas grassed waterways require grade-stabilization structures. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Deep-rooted legumes are generally not suitable because of wetness and the restricted rooting depth. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and sides of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

93D2—Cotton silt loam, 8 to 15 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, brown, friable silt loam

Subsoil:
- 6 to 10 inches, dark yellowish brown, friable silt loam
- 10 to 15 inches, dark yellowish brown, mottled, firm silty clay loam
- 15 to 32 inches, mottled, yellowish brown and grayish brown, firm silty clay and silty clay loam
- 32 to 51 inches, dense layer of dark yellowish brown and brown, mottled, very firm, brittle silt loam
- 51 to 60 inches, dense layer of mottled, brown and grayish brown, very firm, brittle very gravelly silt loam

In some eroded areas the surface layer is silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Wrengart soils and the well drained Goss soils. Goss soils are on the steeper slopes below the Cotton soil. Wrengart soils have less clay in the subsoil than the Cotton soil. They are in the more convex areas. Included soils make up about 5 percent of the unit.

Important properties of the Cotton soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for pasture and hay crops. A few areas are used as cropland, and some areas are wooded. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Deep-rooted legumes are generally not suitable because of wetness and the restricted rooting depth. Erosion control is the main management concern. Maintaining a good vegetative cover improves production. Planting nurse crops improves the vegetative cover and reduces the hazard of erosion when new seedings are established. Timely tillage on the contour and a quickly established ground cover help to minimize soil loss.

This soil is suited to cultivated crops on a limited basis. If cultivated crops are grown, the hazard of further erosion is severe. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, grassed waterways, contour farming, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential, the wetness, and the slope are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and sides of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cut and fill may be necessary because of the slope.

The land capability classification is IVe. The woodland ordination symbol is 3C.

94B—Weller silt loam, 2 to 5 percent slopes. This very deep, gently sloping, moderately well drained soil is on the summits of ridges and structural benches in the uplands. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the

layers of this soil are as follows

Surface layer:
0 to 8 inches, dark brown, friable silt loam

Subsurface layer:
8 to 13 inches, brown, friable silt loam

Subsoil:
13 to 29 inches, yellowish brown, mottled, firm silt loam and very firm silty clay
29 to 60 inches, mottled, yellowish brown and grayish brown, firm silty clay loam

In places the subsoil has a dense layer. In some areas the subsoil contains less clay. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Arisburg soils. These soils have a dark surface layer more than 10 inches thick. They are on broad summits. They make up about 5 to 10 percent of the unit.

Important properties of the Weller soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled, or alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

94B2—Weller silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, moderately well drained soil commonly is on the shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, brown, friable silt loam

Subsoil:
6 to 12 inches, brown, mottled, very firm silty clay loam
12 to 19 inches, mottled grayish brown and yellowish brown, firm silty clay
19 to 60 inches, grayish brown and light brownish gray, mottled, firm silty clay loam

In places the subsoil has a dense layer. In some areas the subsoil contains less clay. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Arisburg and Winfield soils. Arisburg soils are somewhat poorly drained and are on slopes above the Weller soil. Winfield soils have less clay in the subsoil than the Weller soil. They are in the more rounded areas. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Weller soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled, or alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3C.

94C2—Weller silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil commonly is on the shoulders and back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are irregular in shape and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, brown, friable silt loam

Subsoil:
7 to 60 inches, mottled brown, grayish brown, and light brownish gray, firm silty clay loam

In places the subsoil has a dense layer. In some areas the subsoil contains less clay. In other areas the surface layer is very dark grayish brown. In some places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Winfield soils and the well drained Goss soils. Goss soils are in the steeper areas. Winfield soils have less clay in the subsoil than the Weller soil. They are in rounded areas. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Weller soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low

Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cropland, pasture, or hay crops. A few areas are wooded. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. In areas where the formation of gullies is likely, grade-stabilization structures and grassed waterways are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture or hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the wetness are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading may be necessary to modify the slope. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled, or alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

94D2—Weller silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, brown, friable silt loam

Subsoil:
7 to 17 inches, brown, mottled, firm silty clay loam
17 to 60 inches, mottled, grayish brown and yellowish brown, firm silty clay loam and silty clay

In some areas the surface layer is silty clay loam. In other areas the subsoil has a dense layer. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the well drained Bluelick and Goss soils. These soils are in the lower, steeper areas. They make up about 5 percent of the unit.

Important properties of the Weller soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for pasture and hay crops. A few areas are used as cropland, and some areas are wooded. This soil is well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. Species that are tolerant of wetness should be selected. Erosion control is the main management concern. Maintaining a good cover of vegetation improves production. Planting

nurse crops improves the vegetative cover and reduces the hazard of erosion when new seedings are established. Timely tillage on the contour and a quickly established ground cover help to minimize soil loss.

This soil is suited to cultivated crops only on a limited basis. If cultivated crops are grown, the hazard of erosion is severe. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and conservation cropping systems that include rotations of pasture and hay crops or winter wheat. In areas where the formation of gullies is likely, grade-stabilization structures and grassed waterways are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the major concerns affecting timber management. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential, wetness, and the slope are severe limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading generally is necessary to modify the slope. The soil is unsuited to conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the area can be leveled, or alternate sites that are better suited can be selected.

Low strength, the shrink-swell potential, the wetness, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cut and fill may be necessary because of the slope.

The land capability classification is IVe. The woodland ordination symbol is 3C.

95C—Wrengart silt loam, 3 to 8 percent slopes. This very deep, gently sloping and moderately sloping, moderately well drained soil commonly is on the summits of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, brown, friable silt loam

Subsurface layer:
5 to 10 inches, yellowish brown, friable silt loam

Subsoil:
10 to 25 inches, yellowish brown and dark yellowish brown, firm silty clay loam
25 to 30 inches, strong brown, mottled, firm silty clay loam
30 to 50 inches, dense layer of dark yellowish brown and yellowish brown, mottled, firm and very firm, brittle silt loam
50 to 60 inches, mottled, yellowish brown and grayish brown, very firm extremely gravelly silty clay loam

In some areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Cotton and Goss soils. Cotton soils have more clay in the subsoil than the Wrengart soil. They are in the flatter areas. Goss soils have more gravel in the upper part of the subsoil than the Wrengart soil. They are in the steeper areas. Included soils make up about 5 percent of the unit.

Important properties of the Wrengart soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.0 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few small areas are used for pasture and hay crops. This soil is suited to trees (fig. 15). No major hazards or limitations affect timber management.

Some areas are used for pasture and hay crops. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. The dense layer in the subsoil restricts rooting depth and can result in

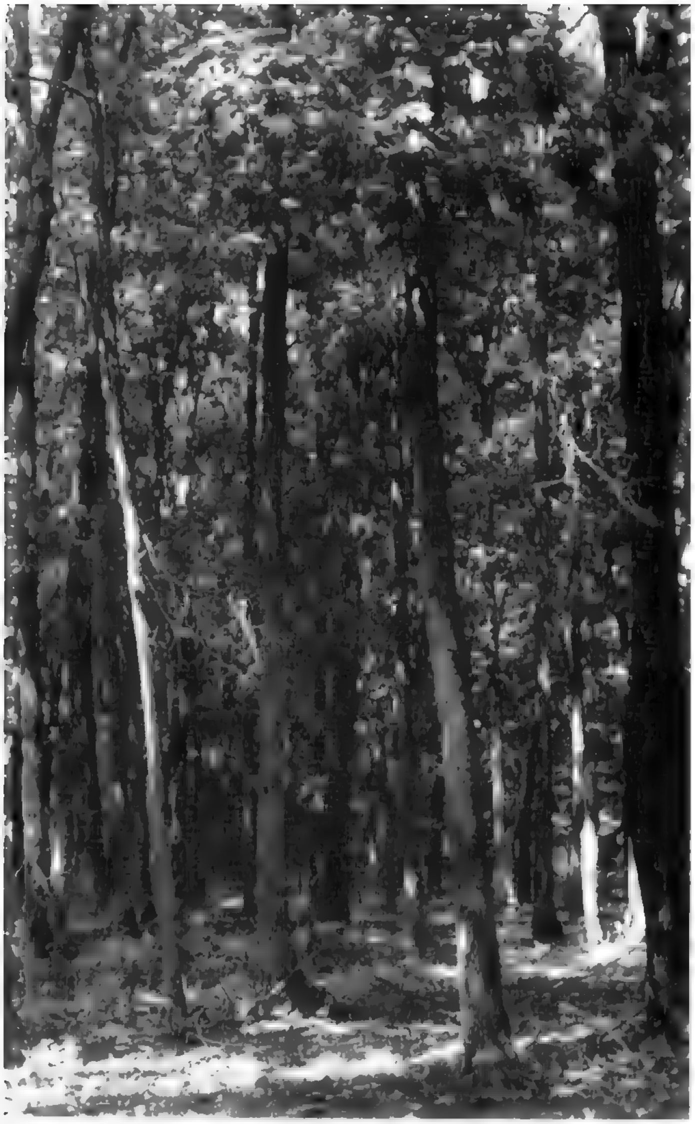

Figure 15.—A stand of red oak and white oak in an area of Wrengart silt loam, 3 to 8 percent slopes.

insufficient soil moisture during dry years. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent the damage caused by wetness. The soil is generally not suited to conventional septic tank absorption fields because of the restricted permeability and wetness. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

95C2—Wrengart silt loam, 3 to 8 percent slopes, eroded. This very deep, gently sloping and moderately sloping, moderately well drained soil commonly is on the summits and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 6 inches, brown, friable silt loam

Subsoil:

6 to 16 inches, dark yellowish brown, firm silty clay loam

16 to 26 inches, dark yellowish brown, mottled, firm silty clay loam

26 to 45 inches, dense layer of dark yellowish brown, mottled, firm, brittle silt loam

45 to 60 inches, yellowish brown, mottled, firm extremely gravelly silty clay loam

60 to 80 inches, red, mottled, firm gravelly silty clay

In some areas the subsoil is gravelly above a depth of 40 inches and has more clay. In places the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Cotton and Goss soils. Cotton soils have more clay in the subsoil than the Wrengart soil. They are on back slopes below the Wrengart soil. Goss soils have gravel in the upper part of the subsoil. They are in the steeper areas. Included soils make up about 5 percent of the unit.

Important properties of the Wrengart soil—

Permeability: Moderately slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.0 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few small areas are used for pasture and hay crops or are wooded. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Terraces are suitable in some areas, but deep cutting can expose gravel in places. The dense layer in the subsoil limits rooting depth and can result in insufficient soil moisture during dry years. Early planting of short-season varieties improves yields. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Some areas are used for pasture and hay crops. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. The dense layer in the subsoil restricts rooting depth and can result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential is a limitation on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. The soil is generally not suited to conventional septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water.

Low strength, the shrink-swell potential, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

95D2—Wrengart silt loam, 8 to 15 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, brown, friable silt loam

Subsoil:
7 to 12 inches, yellowish brown, firm silt loam
12 to 30 inches, dark yellowish brown, mottled, firm silty clay loam
30 to 41 inches, dense layer of dark yellowish brown, very firm, brittle silt loam
41 to 60 inches, strong brown, firm extremely gravelly silt loam

In some areas the subsoil is gravelly above a depth of 40 inches. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Cotton and Goss soils. Cotton soils have more clay in the subsoil than the Wrengart soil. They are on back slopes below the Wrengart soil. Goss soils are gravelly throughout. They are in landscape positions similar to those of the Wrengart soil. Included soils make up about 5 percent of the unit.

Important properties of the Wrengart soil—

Permeability: Moderately slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.0 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. A

few small areas are used for cultivated crops, and some areas are wooded. This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as switchgrass. The dense layer in the subsoil restricts rooting depth and can result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation, preparing the seedbed on the contour, timely tillage, and a quickly established ground cover help to minimize soil loss.

A few areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. Grassed waterways generally require some type of grade-stabilization structure. Terraces are suitable in some areas, but deep cutting can expose gravel in places. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil can be used for building site development or onsite waste disposal systems, but the shrink-swell potential and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Properly installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading may be needed to modify the slope. The soil is generally not suited to conventional septic tank absorption fields because of the restricted permeability. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading roads and streets so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A.

95E—Wrengart silt loam, 15 to 25 percent slopes. This very deep, moderately steep, moderately well drained soil is on the back slopes of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 2 inches, brown, friable silt loam

Subsurface layer:
2 to 8 inches, yellowish brown, friable silt loam

Subsoil:
8 to 13 inches, yellowish brown, firm silt loam
13 to 20 inches, dark yellowish brown, firm silty clay loam
20 to 28 inches, mottled, brown and grayish brown, firm silty clay loam
28 to 41 inches, dense layer of brown and strong brown, firm, brittle silt loam
41 to 46 inches, dense layer of strong brown, firm, brittle silty clay loam
46 to 60 inches, strong brown, mottled, firm very gravelly silty clay loam

In some areas the subsoil is gravelly above a depth of 40 inches and has more clay.

Included with this soil in mapping are small areas of Goss soils, which are gravelly throughout. These soils are in landscape positions similar to those of the Wrengart soil. They make up about 5 percent of the unit.

Important properties of the Wrengart soil—

Permeability: Moderately slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.0 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are wooded. A few areas are used for pasture and hay crops. This soil generally is unsuited to cultivated crops because of the slope and the severe hazard of erosion. It is suited to trees. Equipment limitations and seedling mortality are the main concerns affecting timber management. Establishing roads and skid trails on the contour and installing water bars help to overcome the slope and minimize the concentration of water. Seeding may be needed in disturbed areas

after harvesting is completed. Reinforcement plantings or container-grown stock may be necessary to improve the seedling survival rate. In some steeper areas it may be necessary to yard logs uphill to roads and trails.

A few areas are used for pasture and hay crops. This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and timothy; and to warm-season grasses, such as switchgrass. The dense layer in the subsoil restricts rooting depth and can result in insufficient soil moisture during dry years. Controlling erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation on the contour and a quickly established ground cover help to minimize soil loss. Measures that maintain fertility and that control brush are necessary.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope.

Low strength, the shrink-swell potential, wetness, the potential for frost action, and the slope limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cut and fill may be necessary, or the roads can be designed so that they conform to the natural slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

96C—Winfield silt loam, 3 to 9 percent slopes. This very deep, gently sloping and moderately sloping, moderately well drained soil commonly is on the summits and shoulders of ridges in the uplands. Individual areas are long and narrow and range from 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsurface layer:
7 to 14 inches, brown, friable silt loam

Subsoil:
14 to 24 inches, dark yellowish brown, firm silty clay loam
24 to 50 inches, dark yellowish brown, mottled, firm silty clay loam

Substratum:
50 to 60 inches, dark yellowish brown, mottled, firm silt loam

In some areas the subsoil has a dense layer below a depth of 40 inches. In other areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Bluelick and Weller soils. Bluelick soils have a gravelly layer in the subsoil above a depth of 40 inches. They are in the steeper areas. Weller soils have more clay in the subsoil than the Winfield soil. They are on the flatter summits above the Winfield soil. Included soils make up about 5 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. A few small areas are wooded, and a few areas are used for cultivated crops. Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and conservation cropping systems that include pasture and hay crops or winter wheat. In areas where the formation of gullies is likely, grade-stabilization structures and grassed waterways are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and

basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some land grading may be necessary to modify the slope. The soil is generally not suited to conventional septic tank absorption fields because of the restricted permeability, the wetness, and the slope. Enlarging the absorption field, installing perimeter drains around the field, and mounding or raising the site with suitable fill material help to prevent the contamination of ground water. The lateral lines should be installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

96C2—Winfield silt loam, 3 to 9 percent slopes, eroded. This very deep, gently sloping and moderately sloping, moderately well drained soil commonly is on the back slopes and shoulders of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 8 inches, dark brown, friable silt loam

Subsoil:
- 8 to 28 inches, dark yellowish brown, firm silty clay loam
- 28 to 56 inches, mottled, yellowish brown, brown, and grayish brown, firm silty clay loam

Substratum:
- 56 to 60 inches, grayish brown, mottled, firm silt loam

In some areas the subsoil has a dense layer below a depth of 40 inches. In other areas the surface layer is very dark grayish brown. In places the surface layer is silty clay loam as a result of severe erosion.

Included with this soil in mapping are small areas of Newcomer and Weller soils. Newcomer soils have sandstone bedrock at a depth of 20 to 40 inches. They are in the steeper areas. Weller soils have more clay in the subsoil than the Winfield soil. They are in the less sloping areas. Included soils make up about 5 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for pasture and hay crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of further erosion is a concern. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and a conservation cropping system that includes rotations of pasture and hay crops or winter wheat. In areas where the formation of gullies is likely, grade-stabilization structures and grassed waterways are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to control erosion.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to

prevent the damage caused by wetness. Some land grading may be necessary to modify the slope. The soil is generally unsuited to conventional septic tank absorption fields because of the restricted permeability, the wetness, and the slope. Enlarging the absorption field, properly installing perimeter drains, and mounding or raising the site with suitable fill material help to prevent the contamination of ground water. The lateral lines should be installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

96D2—Winfield silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on the back slopes of ridges in the uplands. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is mixed with the subsurface layer and the upper part of the subsoil. Individual areas of this soil are long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 19 inches, dark yellowish brown, firm silty clay loam
19 to 36 inches, mottled, dark yellowish brown and yellowish brown, firm silty clay loam
36 to 43 inches, mottled, dark yellowish brown and grayish brown, firm silty clay loam

Substratum:
43 to 60 inches, mottled, yellowish brown and grayish brown, firm silt loam

In some places the surface layer is very dark grayish brown. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Newcomer and Weller soils. Newcomer soils have sandstone bedrock at a depth of 20 to 40 inches. They are in the steeper areas. Weller soils have more clay in the subsoil than the Winfield soil. They are in the less sloping areas. Included soils make up about 5 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for pasture and hay crops. A few areas are used for cultivated crops or are wooded. Growing pasture and hay crops helps to control erosion. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Controlling erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to minimize soil loss. Measures that maintain fertility and that control brush are necessary.

This soil is suited to cultivated crops only on a limited basis. It is suited to corn, soybeans, grain sorghum, and winter wheat. If cultivated crops are grown, the hazard of erosion is severe. Measures that help to control erosion include conservation tillage systems that leave a protective cover of crop residue on the surface, winter cover crops, terraces combined with grassed waterways or tile outlets, contour farming, and conservation cropping systems that include pasture and hay crops or winter wheat. In areas where the formation of gullies is likely, grade-stabilization structures and grassed waterways are needed. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No major hazards or limitations affect timber management.

This soil is suitable for building site development and onsite waste disposal systems, but the shrink-swell potential, wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand or gravel help to prevent the damage caused by shrinking and swelling of the soil. Installing drainage tile around the footings helps to prevent damage to foundations and basements. Some

land grading is generally necessary to modify the slope. The soil is generally not suited to conventional septic tank absorption fields because of the restricted permeability, the wetness, and the slope. Enlarging the absorption field, properly installing perimeter drains, and mounding or raising the site with suitable fill material help to prevent the contamination of ground water. The lateral lines should be installed across the slope. Sewage lagoons function adequately if the area can be leveled. Also, sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent the contamination of ground water. Alternate sites that are better suited also can be selected.

Low strength, the shrink-swell potential, the wetness, the slope, and the potential for frost action limit the use of this soil as a site for local roads and streets. Adding crushed rock or other suitable material strengthens the base material. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action. Some cut and fill may be necessary because of the slope.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

99—Zook silty clay loam, occasionally flooded. This very deep, nearly level, poorly drained soil commonly is in backswamps on flood plains along large streams. It is subject to flooding for brief periods. Individual areas are typically long and narrow and range from 5 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, black, firm silty clay loam

Subsurface layer:
9 to 38 inches, black and very dark gray, very firm silty clay

Subsoil:
38 to 60 inches, dark gray, very firm silty clay and dark gray, mottled, firm silty clay

In some areas the soil has a silt loam overwash. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Speed soils. Dockery soils are adjacent to the stream channels below the Zook soil. Speed soils are in the higher areas. Included soils make up about 10 percent of the unit.

Important properties of the Zook soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: High
Seasonal high water table: At the surface to 2 feet below the surface
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. Wetness and flooding are the main management concerns. Land grading, shallow surface ditches, and open lateral ditches help to remove excess water. Spring flooding can delay planting in some years. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes surface crusting, and increases the rate of water infiltration.

This soil is suited to pasture. It is best suited to wetness-tolerant, shallow-rooted legumes, such as alsike clover and ladino clover, and to cool-season grasses, such as bluegrass and redtop. It is suited to warm-season grasses, such as switchgrass. The wetness and the flooding are the main management concerns. Grazing systems should be designed around the periods of possible flooding. Maintaining stands of desirable species is difficult in depressional areas. A drainage system is beneficial for deep-rooted species.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

100—Pits, quarries. This unit consists of upland areas that are being used or were formerly used for limestone quarrying. These areas generally consist of the quarry pits, the stockpiles of lime and crushed rock, the areas covered with overburden spoil, the equipment areas, and the transport roads. A few small areas are borrow pits or strip mines. This unit ranges from 5 to more than 100 acres in size.

The composition of the soils in areas of this unit that are capable of supporting vegetation is quite variable. The vegetation consists primarily of trees, annual weeds, and perennial grasses.

The active quarry pits are dry, but most of the abandoned pits contain water. Most areas where quarry operations are completed or have been abandoned are suitable for some recreational uses and for development as wildlife habitat. Reclaimed land around and between the pits is suitable for grazing. Because areas of this unit are so variable, onsite investigation is needed to determine the suitability for any proposed use.

No land capability classification or woodland ordination symbol is assigned.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 44 percent of the survey area, or 159,437 acres, meets the requirements for prime farmland. Of this acreage, 86,495 acres is prime farmland only where drained or where protected from flooding or not frequently flooded during the growing season. Nearly 125,600 acres of the prime farmland is on uplands in areas that have slopes of 0 to 5 percent. Most of this prime farmland is used for cultivated crops, mainly corn and soybeans.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1989, more than 150,000 acres in Cooper County was used as cropland or hayland. Of this total, 43,700 acres was used for corn and grain sorghum; 45,400 acres for soybeans; 38,800 acres for close-growing crops, predominantly winter wheat; and 36,900 acres for hay (Missouri Crop and Livestock Reporting Service, 1990). The remaining acreage was used mainly as permanent pasture or for conservation purposes or was idle cropland. The conversion of cropland to highways and urban development has been slight since 1967.

Because of fluctuations in livestock production during the 1970's, the acreage used for row crops has increased and that used for permanent pasture has decreased.

The potential of the soils in Cooper County for the sustained production of crops is good. About 44 percent of the county is prime farmland. Some of the marginal cropland used for row crops could be converted to pasture and hayland. Erosion on most of the cropland can be held to a tolerable level by using a system of conservation practices designed for specific sites.

Erosion is a major concern in nearly all sloping areas of cropland and overgrazed pastureland in Cooper County. Soils that have slopes of more than 2 percent are susceptible to damage from erosion. Loss of the surface layer through erosion is damaging for two main reasons. First, productivity is reduced when the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Arisburg, Crestmeade, Cotton, Pershing, and Weller

soils. Erosion also reduces the productivity of soils that tend to be droughty because of a low available water capacity, such as Moko and Goss soils. Second, erosion on farmland can result in the sedimentation of streams, lakes, and ponds. Control of erosion minimizes this pollution and improves the quality of water for municipal use, for recreational uses, and for fish and wildlife. Erosion control also prolongs the usefulness of ponds and lakes by preventing them from filling up with sediment.

Soil blowing is a hazard on Haynie and Sarpy soils if they are not protected by a cover of vegetation. Plowing in the spring, planting winter cover crops, and establishing field windbreaks help to control soil blowing.

Erosion-control practices provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a cover of vegetation or crop residue on the surface can hold erosion losses to a level that will not reduce the productive capacity of the soils. Growing grasses and legumes for pasture and hay is a very effective erosion-control measure. Using legumes, clover, and alfalfa in the crop rotation also improves tilth and provides nitrogen for the following crop.

Terraces can be used to reduce the length of slopes and to help control runoff and erosion. Conventional terraces are practical on upland soils that have long, smooth slopes of less than 8 percent. In the more strongly sloping areas of Winfield and Menfro soils, however, special construction and special management techniques are needed. If areas of the moderately steep Menfro soils are cultivated for row crops, the hazard of erosion can be severe. Terraces that have a grassed back slope reduce the steepness of the slope. Conventional terraces, however, actually increase the steepness of the slope. As a result, additional erosion-control practices are crucial in areas where conventional terraces are used.

In strongly sloping areas, unless conservation tillage is practical, a cropping system that provides substantial vegetative cover is needed for erosion control. Minimizing tillage on sloping soils and leaving a large quantity of crop residue on the surface increase the rate of water infiltration and help to control runoff and erosion.

These practices can be adapted to many of the soils in the county but are more difficult to use successfully on eroded soils that have a clayey surface layer. In some areas of Arisburg, Crestmeade, Cotton, Pershing, and Weller soils, special management is required if terracing has exposed the clayey subsoil. In some areas of Wrengart, Clafork, Bluelick, and Cotton soils, special management is required if terracing has exposed the gravelly subsoil layer.

If the landowner prefers not to construct terraces or if the soil is not suited to terraces, other conservation practices can be used to control erosion. Contour stripcropping involves the use of contoured strips of permanent vegetation. These grass or grass-legume strips are generally used for hay, and the areas between the strips are cultivated. Row crops are planted on the contour (fig. 16). No-till planting is effective in reducing the hazard of erosion on sloping soils. It can be used on many of the soils in the survey area. Severely eroded soils, however, require special management.

Soil wetness is a management concern on about 50 percent of the cropland and pastureland in Cooper County. Soils on uplands, such as Arisburg, Crestmeade, Higginsville, and Leslie soils, have good surface drainage but have somewhat poor internal drainage as a result of moderately slow or slow permeability or because the substratum is less permeable than is needed for proper drainage. These soils stay cold longer in spring than the better drained soils. In some places tile drainage may be needed because of hillside seeps. Tilling in early spring encourages the drying and warming of the surface soil.

Soils on flood plains, such as Bremer and Zook soils, are naturally wet because of their position along the small streams, because of slow permeability, or both. In addition, these soils receive surface water from adjoining uplands. Diversion terraces can be used to intercept the water from the uplands, and shallow surface drains and land shaping can help to remove surface water. The somewhat poorly drained Leta and Waldron soils are on the flood plain along the Missouri River. Field ditches and land shaping generally improve drainage in areas of these soils.

Flooding is a management concern on about 14 percent of the cropland and pastureland in the survey area. Leta, Waldron, and Grable soils, which are on the flood plain along the Missouri River, are subject to occasional flooding. These soils are adequately protected unless a levee breaks or the flooding is very extensive. Most damaging floods occur in May or June.

Ackmore, Bremer, Speed, Dameron, Moniteau, and Zook soils are on the flood plains along the smaller streams. Most of these soils are not protected by levees. Dockery and Sturkie soils, which are on the flood plains along the Lamine River and smaller streams, are frequently flooded. Flooding of the smaller streams generally occurs during the period from November through May, but it can occur at any time of the year or several times a year. This flooding is of shorter duration than the flooding along the Missouri River. Major flood-control measures in the areas along

Figure 16.—Contour farming in an area of Leslie silt loam, 2 to 5 percent slopes, eroded.

the smaller streams are generally not economically feasible.

Streambank erosion along small streams is also a management concern. Tree plantings, rock hark points, and tree revetments help to control streambank erosion (USDA, 1985). The Missouri Department of Conservation and the local office of the Natural Resources Conservation Service can provide additional information about this type of erosion.

Soil fertility is naturally relatively low in most of the eroded soils and in shallow soils. All soils, however, require additional plant nutrients for maximum production. Most of the soils in Cooper County are naturally acid in the upper part of the rooting zone and need applications of ground limestone to raise the pH level and calcium level sufficiently for optimum growth of legumes. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the desired level of production. The Cooperative Extension Service can help to determine the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the uneroded upland soils that are used for crops have a surface layer of dark silt loam that is moderate in content of organic matter. Generally, the structure of silt loam soils becomes weaker as a result of tillage and compaction. Intense rainfall causes the formation of a crust on the surface. The crust is hard when dry. It reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, and other organic material improves soil structure and tilth.

All of the eroded upland soils have more clay in the surface layer and thus have poorer tilth, a slower rate of water infiltration, and a more rapid runoff rate than the corresponding uneroded soils. Conservation practices that help to prevent further erosion are needed in these areas.

Fall plowing is not a desirable practice on most upland soils. Most areas of cropland consist of sloping soils that are subject to damaging erosion if they are plowed in the fall. The clayey Darwin and Zook soils, however, often stay wet until late in the spring. If these

soils are plowed when wet, they tend to become cloddy when dry. The cloddiness makes preparing a seedbed difficult. In areas of these soils, plowing in the fall generally improves tilth. Also, because these soils are nearly level, plowing them in the fall generally does not increase the hazard of erosion.

Pasture and hay crops suited to the soils and climate of Cooper County include several legumes, cool-season grasses, and warm-season native grasses. Alfalfa and red clover are the most common legumes grown for hay. They are also grown with bromegrass, orchardgrass, or timothy for hay and pasture.

Warm-season native grasses adapted to the survey area include big bluestem, little bluestem, Caucasian bluestem, indiangrass, and switchgrass. These grasses are productive during the hot summer months. Warm-season grasses should be planted in April or May. After the stands are established, the fields should be burned off once every 3 to 5 years. This burning stimulates seed production, minimizes the excessive accumulation of plant residue, and helps to control undesirable vegetation.

Very deep, moderately well drained or well drained soils, such as Haynie, Knox, Menfro, Wakenda, and Winfield soils, are best suited to alfalfa and other commonly grown legumes and grasses. Somewhat poorly drained soils, such as Arisburg, Crestmeade, and Higginsville soils, are better suited to ladino clover, lespedeza, tall fescue, reed canarygrass, and switchgrass. Plants that can tolerate wetness should be selected for planting in areas of Bremer, Darwin, McGirk, and Zook soils.

The major management concerns on most of the pastureland in the county are overgrazing and gully erosion. Grazing should be controlled so that plants survive and achieve maximum production. Keeping grasses at a desirable height helps to control runoff and prevent gully erosion.

Two types of irrigation are currently used in Cooper County. These are the center-pivot system and the rain-gun system. These systems increase yields by supplying supplemental water during critical periods of crop growth. Double-cropping is feasible on irrigated soils. Soybeans, for example, can be planted directly into wheat stubble, and enough water can be supplied by irrigation to ensure germination and plant growth.

Soil and water conservation practices should be included when the costs and benefits of an irrigation system are considered. Immediately after irrigation, the saturated topsoil is extremely vulnerable to erosion, which can drastically reduce natural fertility and can cause rapid sedimentation in bodies of water downstream.

Careful maintenance of terraces is also an important management concern. If ruts are allowed to develop where the wheels of the irrigation equipment pass over the saturated berm of the terrace, the effectiveness of the terrace is reduced.

Small acreages of specialty crops, such as strawberries, grapes, and orchards, are grown in Cooper County. These crops require special equipment, management, and propagation techniques.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The

criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

According to estimates by the Missouri Department of Conservation, about 16 percent of Cooper County, or 60,115 acres, was forested in 1986 (Geissman and others, 1986). Woodland tracts in the uplands are primarily small, private holdings of 10 to 15 acres and are essentially unmanaged. Larger continuous tracts of timber are along the bluffs of the Missouri River and Lamine River valleys. On the flood plains, woodland is restricted to long, narrow bands bordering streams and rivers.

Variations in tree species and growth depend on the interaction of site characteristics, soil properties, and management activities.

Soil properties that affect the growth of trees include reaction (pH), fertility, drainage, texture, structure, and soil depth. The soil also serves as a reservoir for moisture, provides an anchor for roots, and supplies essential plant nutrients. Soils in which these properties are not extreme and that have an effective rooting depth of more than 40 inches provide the best medium for timber production.

Site characteristics that affect tree growth include aspect, slope, and topographic position. These site characteristics influence the amount of available sunlight, air drainage, soil temperature, soil moisture, and relative humidity. Generally, north and east aspects and the lower slope positions, which are cooler and have better moisture conditions, are the best upland sites for tree growth. The most productive sites on flood plains are generally areas of deep, moderately well drained soils that are only occasionally flooded.

Management activities can influence woodland productivity and should be aimed at eliminating factors that cause tree stress. Generally, such management includes thinning overstocked young stands; harvesting old, mature trees; and preventing destructive fire and grazing by livestock. Fire and grazing have very negative impacts on forest growth and quality. Forest fires are no longer a major concern in Cooper County, but about 50 percent of the woodland is still subject to grazing by livestock. Grazing destroys the leaf layer on the surface, compacts the soil, and kills or damages tree seedlings. Woodland sites that have not been grazed or burned have the highest potential for optimum

timber production, for wildlife habitat, and for recreational uses.

Goss, Bluelick, Wrengart, and Menfro soils support the largest acreages of upland timber. Typical species are white oak, northern red oak, black oak, black walnut, and sugar maple. Post oak, black oak, shagbark hickory, and blackjack oak occur on the less productive Goss soils on the steeply dissected, weathered limestone slopes. Undisturbed areas of timber on Menfro and Bluelick soils are very productive.

Along the major watercourses, Haynie, Leta, Moniteau, and Dockery soils support bottom-land hardwoods adapted to wet or flooded soil conditions. Many of these sites have been cleared for crop production. The remaining wooded areas typically support silver maple, hackberry, American elm, swamp white oak, sycamore, cottonwood, and pin oak. Bur oak, shellbark hickory, and walnut are common on bottom land along the smaller streams and on the higher terraces of the major streams. A high potential for excellent timber growth exists on these sites.

Specialty tree plantings, such as Christmas trees, nut trees, and fuelwood trees, can be very successful if adapted species are used. Christmas tree plantings can be established on any soil that is not poorly drained or very poorly drained. Species of trees suited to the soils in Cooper County include Scotch pine, Austrian pine, white pine, and Douglas-fir. Nut trees, such as black walnut, are best suited to deep, moderately well drained or well drained soils, such as Menfro, Bluelick, and Winfield soils in the uplands and Haynie, Eudora, and Motark soils on the flood plains. Other soils are also suited to nut trees but may be less productive than the soils in these areas. Tree plantations for fuelwood utilizing fast-growing species are feasible in Cooper County. The species most adaptable for this purpose are green ash, black locust, sycamore, and silver maple.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality

is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

Living plants play an important role in supporting our life and improving its condition. When properly used and maintained, plants provide positive solutions to problems in our contemporary environment. In Cooper County, windbreaks and environmental plantings can be utilized throughout the landscape for a variety of engineering, climatological, and esthetic purposes.

Windbreaks can be grown successfully in most areas of Cooper County. Some important considerations affecting the management of farmstead and field windbreaks are design and layout, species selection, site preparation, seedling handling, weed management, supplemental watering, and protection from diseases, insects, and livestock.

Farmstead windbreaks make the farmstead more comfortable, reduce energy costs, increase yields from gardens and fruit trees, enhance wildlife populations, buffer noises, and increase property values (Scholten, 1988).

Feedlot windbreaks can be used to protect livestock from wind and snow. Windbreaks significantly minimize calf losses, make feeding easier, and enable livestock to maintain better weight with less feed.

Farmstead and feedlot windbreaks are generally three or more rows deep and include at least two rows of coniferous trees. The windbreaks should be established on the windward side of the area to be protected and should be at right angles to the prevailing winds. Well designed farmstead and feedlot windbreaks are needed in Cooper County, especially in the open areas of former prairie soils, such as those in the Clafork-Leslie-Crestmeade association and the Arisburg association, which are described under the heading "General Soil Map Units."

Field windbreaks or shelterbelts protect field crops and areas of bare soil from the effects of strong winds. Field windbreaks minimize soil losses, increase crop yields, help to prevent the spread of weeds, and enhance wildlife populations (Brandle and others, 1988). Careful planning is needed. Field boundaries, irrigation systems, power lines, and roads should be considered when the location of field windbreaks is determined. Windbreaks should be oriented at right angles to the prevailing winds. A typical field windbreak system consists of a series of single rows of trees or shrubs. Field windbreaks are adaptable to many locations in Cooper County but are most beneficial in areas of the Haynie-Waldron-Leta and Clafork-Leslie-Crestmeade associations.

Environmental plantings can be used for beautification, as visual screens, and for control of acoustical and climatological problems around buildings and other living spaces. Plants whose height, shape, color, and texture are compatible with the surrounding area, structures, and desired use should be selected (Robinette, 1972). Trees and shrubs can be easily established in most parts of Cooper County if proper site preparation methods are applied and weeds and other competing vegetation are controlled.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on

Figure 17.—Public accesses along rivers and creeks provide fishing and boating opportunities in Cooper County.

measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Kenneth Kriewitz, area biologist, Missouri Department of Conservation, helped prepare this section.

Cooper County is made up of a mixture of cropland, grassland, and woodland. Recreational opportunities are primarily land based. Public land in the state-operated Lamine River Wildlife Area and Prairie Home

Wildlife Area provides opportunities for camping, hiking, and hunting. The mixture of agricultural lands and rolling topography has resulted in good opportunities for upland game hunting.

The Missouri River forms the northern boundary of the county. The Lamine River flows through the western part of the county, and Petite Saline Creek is in the northern part. These watercourses provide excellent fishing for catfish. There are several public accesses for boat launching (fig. 17). Moniteau Creek, in the southern part of the county, provides fishing for bass and perch.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Kenneth Kriewitz, area biologist, Missouri Department of Conservation, helped prepare this section.

Cooper County is one of 13 counties in Missouri that make up the west prairie zoogeographic region (Nagel, 1970). Prior to settlement, the primary vegetation was tall prairie grasses. Oak hickory forests were along the major streams. In 1990, about 42 percent of the acreage in the county was pastureland and no significant areas of prairie remained. About 42 percent of the acreage was cropland, and about 16 percent was woodland. Problems affecting wildlife resources include the loss of habitat resulting from the conversion of land use to agriculture, the enlargement of fields, and the lack of suitable edge growth in the transitional zone between areas covered by different types of vegetation.

The Lamine River Wildlife Area and Prairie Home Wildlife Area are the only public hunting lands in the county. The vast majority of the wildlife habitat is controlled by private landowners, and access for hunting is becoming more limited. The game species in

the county are primarily those that favor openland habitat.

Songbird populations are good in each of the associations described under the heading "General Soil Map Units." Furbearer populations are also good. Raccoon, opossum, muskrat, coyote, mink, and beaver are the main furbearers trapped in the county.

More than 50 percent of the acreage in the Haynie-Waldron-Leta, Clafork-Leslie-Crestmeade, Dockery-Speed-Moniteau, and Arisburg associations is cropland or grassland. These associations provide the primary openland wildlife habitat in the county. Waterways, hedgerows, fence rows, small tracts of timber, and other areas of woody or brushy cover in these associations provide the edge growth essential for the majority of openland wildlife species. These key habitat areas are disappearing in the more intensively cultivated areas of the county. The amount of such habitat should increase as a result of the Conservation Reserve Program, which pays landowners to plant grass or trees on highly erodible fields. As of 1992, about 18,000 acres in the county had been enrolled in the Conservation Reserve Program.

Quail and rabbit populations are good in Cooper County, and the dove population is fair. Migratory flights during the hunting season in the fall enhance the dove population. Ringneck pheasants inhabit the northern part of the county, but the number of these birds is small.

About 30 percent of the acreage in the Menfro association and the Goss-Wrengart-Bluelick association is woodland. These are the only associations that include a significant amount of woodland cover, which provides the primary habitat for woodland wildlife species. Deer and turkey populations are good and are increasing. The squirrel population is excellent.

Wetland habitat is by far the most scarce habitat type in the county. Only the Haynie-Waldron-Leta and Dockery-Speed-Moniteau associations have any wetland habitat. Many of the soils in these associations once sustained wetlands, but they have been drained for agricultural use. Only a few small natural wetlands remain. Good populations of Canada geese and ducks use the flood plains during periods of high water in the fall. Migratory flights add to this number each spring and fall.

The survey area has more than 175 miles of perennial streams. The Missouri, Blackwater, and Lamine Rivers and Petite Saline and Moniteau Creeks provide sport fishing. The Missouri River is fished for carp, buffalo, flathead catfish, and channel catfish. Bluegill, crappie, largemouth bass, flathead catfish, and channel catfish are caught in the major streams. Recent estimates indicate that more than 70 percent of the farm ponds and small lakes in the county have been stocked with fish.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are

fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial,

and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for

use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils

are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree

and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

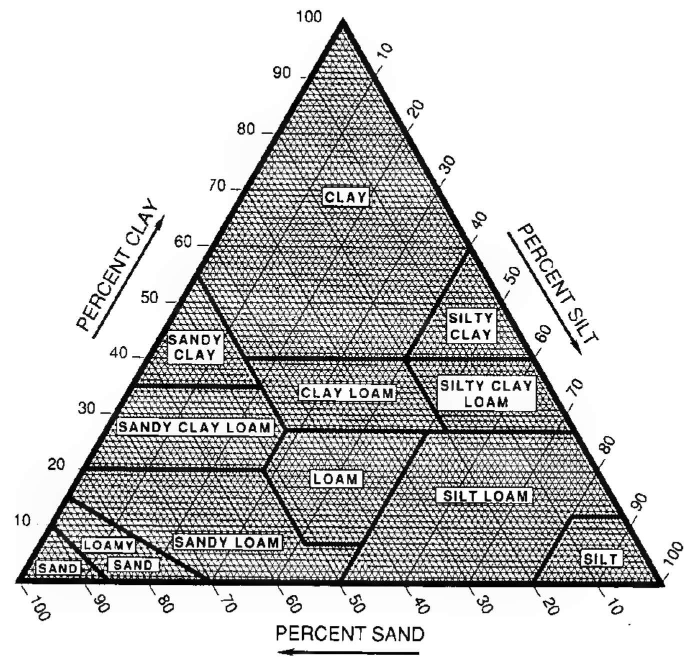

Figure 18.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 18). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and

clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops

and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist

mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion

of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalf (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ackmore Series

The Ackmore series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Ackmore silt loam, occasionally flooded, 200 feet south and 2,250 feet east of the northwest corner of sec. 19, T. 48 N., R. 16 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few very fine roots; neutral; abrupt smooth boundary.

C—9 to 24 inches; very dark gray (10YR 3/1) and grayish brown (10YR 5/2) layers of silt loam; few thin very dark grayish brown (10YR 3/2) strata; massive; friable; few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; neutral; clear smooth boundary.

2Ab1—24 to 33 inches; very dark gray (10YR 3/1) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

2Ab2—33 to 47 inches; black (10YR 2/1) silty clay loam; strong very fine subangular blocky structure; very firm; few very fine roots; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

2Ab3—47 to 60 inches; very dark gray (10YR 3/1) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; firm; few very fine roots; few shiny pressure faces; neutral.

The A horizon has chroma of 1 or 2. The C horizon has value of 3 to 5 and chroma of 1 or 2. The 2Ab horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. It is silty clay loam or silt loam.

Arisburg Series

The Arisburg series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slopes range from 1 to 5 percent.

Typical pedon of Arisburg silt loam, 1 to 5 percent slopes, 700 feet east and 2,300 feet south of the northwest corner of sec. 13, T. 48 N., R. 18 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many very fine roots; neutral; abrupt smooth boundary.

A—6 to 13 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; friable; common very fine roots; few fine iron and manganese oxide accumulations; neutral; clear smooth boundary.

AB—13 to 19 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; many prominent organic coatings on faces of peds; slightly acid; gradual smooth boundary.

Btg1—19 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; few fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct organic coatings on faces of peds; moderately acid; gradual smooth boundary.

Btg2—26 to 36 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; many fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few fine faint grayish brown (10YR 5/2) iron depletions throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Btg3—36 to 47 inches; grayish brown (2.5Y 5/2) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; many fine prominent yellowish brown (10YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Btg4—47 to 56 inches; grayish brown (2.5Y 5/2) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Cg—56 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; massive; firm; few very fine roots; few distinct clay films in root channels; common fine prominent yellowish brown (10YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y and chroma of 2 to 4. The Btg horizon has hue of 2.5Y or 5Y, value

of 4 or 5, and chroma of 2 to 4. The Cg horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam or silt loam.

Arisburg silt loam, 5 to 9 percent slopes, eroded, has a thinner dark surface soil than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soil.

Bluelick Series

The Bluelick series consists of very deep, well drained, moderately slowly permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying cherty limestone residuum. Slopes range from 3 to 25 percent.

Typical pedon of Bluelick silt loam, 15 to 25 percent slopes, eroded (fig. 19), 1,900 feet north and 2,400 feet east of the southwest corner of sec. 6, T. 48 N., R. 18 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many very fine roots; moderately acid; abrupt smooth boundary.

Bt1—7 to 11 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—11 to 20 inches; strong brown (7.5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

Bt3—20 to 26 inches; yellowish red (5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; common fine iron and manganese oxide accumulations; strongly acid; clear smooth boundary.

2Bt4—26 to 38 inches; red (2.5YR 4/6) very gravelly silty clay; strong very fine subangular blocky structure; very firm; common very fine roots; many prominent clay films on faces of peds; common fine iron and manganese oxide accumulations; 35 percent chert gravel and 10 percent chert cobbles; strongly acid; gradual smooth boundary.

2Bt5—38 to 51 inches; dark red (2.5YR 3/6) extremely gravelly clay; strong very fine subangular blocky structure; very firm; few very fine roots; common prominent clay films on faces of peds; 65 percent chert gravel and 10 percent chert cobbles; strongly acid; gradual smooth boundary.

2Bt6—51 to 60 inches; dark red (2.5YR 3/6) very gravelly clay; strong very fine subangular blocky structure; very firm; few very fine roots; common prominent clay films on faces of peds; 35 percent chert gravel and 10 percent limestone cobbles; slightly acid.

The A and Ap horizons have value of 3 or 4 and chroma of 2 or 3. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay. The content of gravel in this horizon ranges from 0 to 10 percent. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 5, and chroma of 4 to 6. It is very gravelly or extremely gravelly silty clay or clay. The content of gravel in this horizon ranges from 35 to 70 percent, and the content of cobbles ranges from 0 to 10 percent.

Bremer Series

The Bremer series consists of very deep, poorly drained, moderately slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silt loam, occasionally flooded, 200 feet west and 1,100 feet north of the southeast corner of sec. 15, T. 48 N., R. 19 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; few very fine roots; common distinct organic stains on faces of peds; few fine iron and manganese oxide stains; neutral; clear smooth boundary.

Bt1—14 to 23 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine distinct dark yellowish brown (10YR 3/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct organic stains on faces of peds; slightly acid; gradual smooth boundary.

Bt2—23 to 29 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; strong fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; common distinct clay films on faces of peds; few fine prominent dark brown (7.5YR 4/4) and few fine distinct dark yellowish brown (10YR 3/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct

organic stains on faces of peds; moderately acid; clear smooth boundary.

Btg1—29 to 39 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine subangular blocky structure; very firm; few very fine roots; common shiny pressure faces; many distinct clay films on faces of peds; few fine prominent strong brown (7.5YR 4/6) and few fine faint grayish brown (2.5Y 5/2) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Btg2—39 to 48 inches; grayish brown (2.5Y 5/2) and light brownish gray (10YR 6/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) and few fine prominent yellowish brown (10YR 5/8) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

BCg—48 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; weak medium subangular blocky structure parting to weak very fine subangular blocky; firm; few very fine roots; few distinct clay films on faces of peds; common fine prominent dark yellowish brown (10YR 4/6) and few medium prominent yellowish red (5YR 5/8) masses of iron accumulation throughout; few distinct organic stains on faces of peds; moderately acid.

The mollic epipedon ranges from 24 to 36 inches in thickness. The A horizon has value of 2 or 3 and chroma of 0 or 1. The Btg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The BCg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Buckney Series

The Buckney series consists of very deep, somewhat excessively drained, moderately rapidly permeable soils on the flood plain along the Missouri River. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Buckney fine sandy loam, occasionally flooded, 800 feet west and 5,075 feet north of the southeast corner of sec. 5, T. 48 N., R. 15 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

A—10 to 15 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable; few very fine roots; common distinct organic coatings on faces of peds; neutral; clear smooth boundary.

C1—15 to 44 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; few very fine roots; neutral; clear smooth boundary.

C2—44 to 60 inches; brown (10YR 5/3) fine sand; single grain; loose; few very fine roots; neutral.

The A horizon has chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 2 to 4.

Bunceton Series

The Bunceton series consists of very deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess and in the underlying cherty limestone residuum. Slopes range from 3 to 15 percent.

Typical pedon of Bunceton silt loam, 3 to 8 percent slopes, 450 feet east and 1,400 feet south of the northwest corner of sec. 33, T. 47 N., R. 17 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; many very fine roots; slightly acid; clear smooth boundary.

BE—8 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak very fine subangular blocky structure; friable; many very fine roots; few fine iron and manganese oxide accumulations; few distinct silt coatings and common distinct organic coatings on faces of peds; neutral; clear smooth boundary.

Bt1—11 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; many very fine roots; many prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; neutral; gradual smooth boundary.

Bt2—21 to 31 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; common very fine roots; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; slightly acid; gradual smooth boundary.

2Btx1—31 to 39 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure; firm; common very fine roots; few distinct clay films on faces of peds; few medium iron and manganese oxide accumulations; 2 percent chert gravel; 55 percent weak brittleness; slightly acid; gradual smooth boundary.

2Btx2—39 to 48 inches; strong brown (7.5YR 4/6) silty clay loam; weak coarse subangular blocky structure;

firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; 5 percent chert gravel; 50 percent weak brittleness; common distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

3Bt—48 to 60 inches; brown (7.5YR 5/4) and strong brown (7.5YR 5/6) extremely gravelly silt loam; moderate very fine subangular blocky structure; firm; many very fine roots; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; 60 percent chert gravel, 5 percent chert cobbles, 5 percent chert stones; moderately acid.

The Ap horizon has chroma of 2 or 3. The E horizon, if it occurs, has value of 4 or 5 and chroma of 4 to 6. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. The 2Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 3Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is gravelly to extremely gravelly silt loam, silty clay loam, or silty clay. The content of gravel in this horizon ranges from 30 to 80 percent, the content of cobbles ranges from 0 to 10 percent, and the content of stones ranges from 0 to 10 percent.

Chauncey Series

The Chauncey series consists of very deep, poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 3 percent.

Typical pedon of Chauncey silt loam, 0 to 3 percent slopes, 1,850 feet west and 1,700 feet south of the northeast corner of sec. 30, T. 46 N., R. 17 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; few very fine roots; few fine iron and manganese oxide accumulations; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; few very fine roots; few fine iron and manganese oxide accumulations; moderately acid; clear smooth boundary.

E1—12 to 17 inches; grayish brown (10YR 5/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few very fine roots; few fine iron and manganese oxide stains; many distinct organic coatings on faces of peds; moderately acid; clear smooth boundary.

E2—17 to 26 inches; grayish brown (10YR 5/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few very fine roots; few fine distinct gray (5Y 5/1) iron depletions throughout; few fine iron and manganese oxide stains; many distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

Btg1—26 to 32 inches; dark grayish brown (2.5Y 4/2) silty clay; strong fine subangular blocky structure; very firm; common fine roots; many distinct clay films on faces of peds; common fine prominent yellowish red (5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Btg2—32 to 38 inches; dark grayish brown (2.5Y 4/2) silty clay; moderate fine subangular blocky structure; very firm; few very fine roots; few fine prominent yellowish red (5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Btg3—38 to 47 inches; dark grayish brown (2.5Y 4/2) silty clay; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; many fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Btg4—47 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; many fine prominent yellowish brown (10YR 5/8) and few medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; slightly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 5 or 6 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or less.

Clafork Series

The Clafork series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loess and in the underlying cherty limestone residuum. Slopes range from 2 to 8 percent.

Typical pedon of Clafork silt loam, 2 to 5 percent slopes, 1,600 feet west and 1,670 feet south of the northeast corner of sec. 6, T. 45 N., R. 16 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many very fine roots; few

fine iron and manganese oxide accumulations; neutral; abrupt smooth boundary.

E—8 to 11 inches; brown (10YR 5/3) silt loam; weak very fine subangular blocky structure; friable; many very fine roots; few fine prominent strong brown (7.5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; slightly acid; clear smooth boundary.

Btg1—11 to 16 inches; dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) silty clay loam; moderate very fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; common fine prominent red (2.5YR 4/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; the areas of grayish brown are iron depletions; few distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg2—16 to 23 inches; dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) silty clay; strong very fine subangular blocky structure; very firm; few very fine roots; many prominent clay films on faces of peds; common fine prominent red (2.5YR 4/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

Btg3—23 to 31 inches; dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) silty clay; strong very fine subangular blocky structure; very firm; few very fine roots; many distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Btg4—31 to 39 inches; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) silty clay loam; strong fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/8) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

2Btgx1—39 to 49 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure; very firm; few very fine roots; few distinct clay films on vertical faces of peds; common fine prominent strong brown (7.5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 40 percent weak brittleness; few distinct silt coatings on faces of peds; neutral; clear smooth boundary.

2Btgx2—49 to 59 inches; grayish brown (10YR 5/2) silt loam; weak coarse prismatic structure; very firm; few very fine roots; few distinct clay films in root channels and on vertical faces of peds; common fine prominent strong brown (7.5YR 4/8) and common fine distinct yellowish brown (10YR 5/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 4 percent chert gravel; 50 percent weak brittleness; many distinct silt coatings on vertical faces of peds; slightly alkaline; clear smooth boundary.

3Btgx3—59 to 72 inches; grayish brown (10YR 5/2) very gravelly silt loam; weak fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 50 percent chert gravel; 40 percent weak brittleness; slightly alkaline; clear smooth boundary.

4Bt—72 to 80 inches; red (2.5YR 4/8) and dark red (2.5YR 3/6) very gravelly silty clay; strong very fine subangular blocky structure; very firm; few very fine roots; common pressure faces; many prominent clay films on faces of peds; few fine iron and manganese oxide stains; 50 percent chert gravel, 10 percent cobbles; slightly alkaline.

The A or Ap horizon has value and chroma of 2 or 3. The E horizon, if it occurs, has value of 4 to 7 and chroma of 2 to 4. The upper part of the Bt horizon commonly has value of 4 or 5. The lower part has value of 4 or 5 and chroma of 2 to 6. This horizon is silty clay loam or silty clay. The 2Btgx horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is silt loam or silty clay loam. The 3Btgx horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 1 to 6. It is extremely gravelly or very gravelly silt loam or silty clay loam. The 4Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 6, and chroma of 1 to 8. It is very gravelly or extremely gravelly silty clay loam or silty clay.

Cotton Series

The Cotton series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in a thin mantle of loess and in the underlying cherty limestone residuum. Slopes range from 2 to 15 percent.

Typical pedon of Cotton silt loam, 2 to 5 percent slopes, 3,000 feet east and 1,300 feet south of the northwest corner of sec. 26, T. 46 N., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many very fine roots; few fine iron and manganese oxide accumulations; neutral; abrupt smooth boundary.

E—8 to 14 inches; pale brown (10YR 6/3) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt—14 to 19 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; many very fine roots; few distinct clay films on faces of peds; few fine distinct grayish brown (10YR 5/2) iron depletions and few fine prominent strong brown (7.5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg1—19 to 28 inches; dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and yellowish red (5YR 5/8) silty clay; strong very fine subangular blocky structure; very firm; common very fine roots; many prominent clay films on faces of peds; few fine iron and manganese concretions; the areas of dark yellowish brown and yellowish red are iron accumulations; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg2—28 to 33 inches; dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/8) silty clay; moderate very fine subangular blocky structure; very firm; common very fine roots; common prominent clay films on faces of peds; few fine iron and manganese concretions; the areas of dark yellowish brown and yellowish brown are iron accumulations; few distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

2Btx1—33 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure; very firm; few very fine roots; few distinct clay films on vertical faces of peds; 60 percent weak brittleness; common fine distinct yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide stains; common prominent silt coatings on faces of peds; moderately acid; gradual smooth boundary.

2Btx2—42 to 54 inches; yellowish brown (10YR 5/4) silt loam; weak coarse prismatic structure; very firm; few very fine roots; few distinct clay films in root channels and on vertical faces of peds; 55 percent weak brittleness; few fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide stains; 2 percent chert gravel; common distinct silt coatings on faces of peds; slightly acid; clear smooth boundary.

3Btx3—54 to 60 inches; yellowish brown (10YR 5/4), grayish brown (10YR 5/2), and dark yellowish brown (10YR 4/6) very gravelly silt loam; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; 40 percent chert gravel, 10 percent chert stones; 30 percent weak brittleness; few fine iron and manganese oxide stains; the areas of grayish brown are iron depletions; the areas of dark yellowish brown are masses of iron accumulation; common distinct silt coatings on faces of peds; neutral.

The Ap horizon has chroma of 2 or 3. The E horizon, if it occurs, has value of 4 to 7 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8. It is silt loam, silty clay loam, or silty clay. The 2Btx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam, silt loam, or silty clay loam. The content of gravel in this horizon ranges from 0 to 5 percent. The 3Btx horizon has hue of 10YR or 2.5YR, value of 3 to 6, and chroma of 1 to 6. It is very gravelly or extremely gravelly silt loam or silty clay loam. The content of gravel in this horizon ranges from 30 to 70 percent, the content of cobbles ranges from 0 to 10 percent, and the content of stones ranges from 0 to 10 percent.

Crestmeade Series

The Crestmeade series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 4 percent.

Typical pedon of Crestmeade silt loam, 0 to 2 percent slopes, 2,000 feet east and 300 feet south of the northwest corner of sec. 5, T. 45 N., R. 17 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

E—11 to 18 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many very fine roots; few distinct organic coatings on faces of peds; many prominent silt coatings; few fine iron and manganese concretions; moderately acid; abrupt smooth boundary.

Bt—18 to 24 inches; dark brown (7.5YR 3/2) silty clay,

dark brown (10YR 3/3) dry; moderate fine subangular blocky structure; firm; many very fine roots; many prominent clay films on faces of peds; common shiny pressure faces; common fine prominent yellowish red (5YR 4/6) and common fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese concretions; moderately acid; gradual smooth boundary.

Btg1—24 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay; moderate fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; common shiny pressure faces; few fine prominent strong brown (7.5YR 4/6) and common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese concretions; moderately acid; gradual smooth boundary.

Btg2—34 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few shiny pressure faces; many fine prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese concretions; few distinct silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Btg3—42 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese concretions; neutral; gradual smooth boundary.

Cg—52 to 60 inches; gray (10YR 5/1) silty clay loam; massive; firm; few very fine roots; few distinct clay films in root channels; common fine prominent dark yellowish brown (10YR 4/6) and few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese concretions; neutral.

The Ap or A horizon has value of 2 or 3. The E horizon, if it occurs, has value of 4 to 6 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silty clay. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silt loam.

Crestmeade silt loam, 1 to 4 percent slopes, eroded, does not have the leached subsurface horizon that is defined for the series. This difference, however, does not significantly affect the use and management of the soil.

Dameron Series

The Dameron series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in silty and gravelly alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Dameron silt loam, 0 to 3 percent slopes, occasionally flooded (fig. 20), 400 feet east and 260 feet north of the southwest corner of sec. 11, T. 46 N., R. 17 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many fine and very fine roots; moderately acid; abrupt smooth boundary.

A1—8 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common very fine roots; 4 percent chert gravel; few distinct organic coatings on faces of peds; strongly acid; clear smooth boundary.

A2—18 to 28 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; few very fine roots; 8 percent chert gravel; common distinct organic coatings on faces of peds; strongly acid; clear smooth boundary.

2C1—28 to 37 inches; very dark grayish brown (10YR 3/2) very gravelly silty clay loam, brown (10YR 5/3) dry; massive; firm; few very fine roots; 45 percent chert gravel; 1 percent chert cobbles; common distinct organic coatings on faces of peds; slightly acid; gradual smooth boundary.

2C2—37 to 42 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, brown (10YR 5/3) dry; massive; firm; few very fine roots; 55 percent chert gravel, 1 percent chert cobbles; slightly acid; gradual smooth boundary.

2C3—42 to 60 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, brown (10YR 5/3) dry; massive; firm; few very fine roots; 50 percent chert gravel, 5 percent chert cobbles; common fine iron and manganese oxide stains; common distinct organic coatings; slightly acid.

The Ap or A horizon has value and chroma of 2 or 3. The content of gravel in this horizon ranges from 0 to 10 percent. The 2C horizon has value of 3 or 4 and

chroma of 2 to 4. It is gravelly or very gravelly silty clay loam or clay loam. The content of gravel in this horizon ranges from 25 to 60 percent.

Darwin Series

The Darwin series consists of very deep, poorly drained, very slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Darwin silty clay, occasionally flooded, 2,600 feet east and 1,700 feet south of the northwest corner of sec. 10, T. 48 N., R. 15 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate fine granular structure; firm; few very fine roots; slightly alkaline; abrupt smooth boundary.

Bg1—10 to 20 inches; dark gray (10YR 4/1) silty clay; strong fine angular blocky structure; very firm; few very fine roots; few pressure faces; few fine prominent reddish brown (5YR 4/4) masses of iron accumulation; neutral; clear smooth boundary.

Bg2—20 to 32 inches; dark grayish brown (2.5Y 4/2) silty clay; strong fine angular blocky structure; very firm; few very fine roots; few pressure faces; common fine prominent yellowish brown (10YR 5/4) masses of iron accumulation; neutral; gradual smooth boundary.

Bg3—32 to 45 inches; dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) silty clay; strong fine angular blocky structure; very firm; few very fine roots; few pressure faces; common fine prominent yellowish brown (10YR 5/6) masses of iron accumulation; neutral; gradual smooth boundary.

Bg4—45 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay; moderate medium subangular blocky structure; very firm; few very fine roots; few pressure faces; common fine prominent yellowish brown (10YR 5/6) masses of iron accumulation and common fine faint grayish brown (2.5Y 5/2) iron depletions throughout; slightly alkaline.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 2 or less. The Bg horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 2 or less. It typically is silty clay, but the range includes silty clay loam in the lower part.

Dockery Series

The Dockery series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Dockery silt loam, frequently flooded (fig. 21), 175 feet east and 1,500 feet south of the northwest corner of sec. 26, T. 48 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

C—7 to 21 inches; dark brown (10YR 3/3) silt loam; massive; friable; few very fine roots; few thin light brownish gray (10YR 6/2) strata; few fine distinct dark grayish brown (10YR 4/2) iron depletions; common fine prominent dark yellowish brown (10YR 4/6) iron stains along strata partings; slightly acid; clear smooth boundary.

Cg1—21 to 38 inches; very dark gray (10YR 3/1) silt loam; massive; friable; few very fine roots; few thin grayish brown (10YR 5/2) strata; common fine prominent dark yellowish brown (10YR 4/6) iron depletions; slightly acid; gradual smooth boundary.

Cg2—38 to 52 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) layers of silt loam; massive; friable; few very fine roots; few thin grayish brown (10YR 5/2) strata; common fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; slightly acid; abrupt smooth boundary.

Cg3—52 to 60 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) layers of silt loam; massive; friable; few very fine roots; few thin very dark gray (10YR 3/1) strata; common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation; slightly acid.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The C horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 to 3. It is silt loam or silty clay loam.

Eldon Series

The Eldon series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in cherty limestone residuum. Slopes range from 8 to 15 percent.

Typical pedon of Eldon gravelly silt loam, 8 to 15 percent slopes, 1,900 feet east and 225 feet north of the southwest corner of sec. 28, T. 46 N., R. 18 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable; many medium roots; 10 percent chert gravel; strongly acid; clear smooth boundary.

BE—6 to 18 inches; dark brown (10YR 4/3) gravelly silt

loam; moderate fine subangular blocky structure; friable; common very fine roots; 30 percent chert gravel; few faint silt coatings; strongly acid; gradual smooth boundary.

Bt1—18 to 28 inches; dark brown (7.5YR 4/4) extremely gravelly silty clay; strong fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; few fine prominent yellowish red (5YR 4/6) masses of iron accumulation; 50 percent chert gravel, 10 percent chert cobbles, 5 percent chert stones; moderately acid; gradual smooth boundary.

Bt2—28 to 36 inches; yellowish red (5YR 4/6) extremely gravelly clay; strong fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; few fine prominent red (2.5YR 4/6) masses of iron accumulation; 55 percent chert gravel, 10 percent chert cobbles, 5 percent chert stones; moderately acid; clear smooth boundary.

Bt3—36 to 47 inches; red (2.5YR 4/6) extremely gravelly clay; few fine prominent strong brown (7.5YR 4/6) mottles; strong very fine subangular blocky structure; very firm; few very fine roots; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; 55 percent chert gravel, 10 percent chert cobbles, 5 percent chert stones; moderately acid; clear smooth boundary.

2Bt4—47 to 60 inches; red (2.5YR 4/6) clay; few fine prominent strong brown (7.5YR 5/6) mottles; strong very fine subangular blocky structure; very firm; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; 5 percent chert gravel; slightly acid.

The Ap horizon has chroma of 2 or 3. The content of gravel in this horizon ranges from 5 to 20 percent, and the content of cobbles and stones ranges from 3 to 10 percent. The Bt horizon has hue of 10YR to 2.5YR and chroma of 4 to 6. It is very gravelly or extremely gravelly silty clay or clay. The content of gravel in this horizon ranges from 30 to 60 percent, and the content of cobbles and stones ranges from 5 to 15 percent. The 2Bt horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. It is silty clay or clay or the gravelly analogs of these textures. The content of gravel in this horizon ranges from 0 to 20 percent.

Eudora Series

The Eudora series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Eudora loam, sandy substratum, occasionally flooded, 2,575 feet west and 850 feet north of the southeast corner of sec. 32, T. 49 N., R. 15 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; few very fine roots; slightly alkaline; abrupt smooth boundary.

A—10 to 17 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; friable; many very fine roots; common distinct organic coatings; slightly alkaline; clear smooth boundary.

Bw1—17 to 23 inches; dark brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; friable; common very fine roots; common distinct organic coatings; slightly alkaline; clear smooth boundary.

Bw2—23 to 31 inches; brown (10YR 5/3) silt loam; moderate fine subangular blocky structure; friable; common very fine roots; few faint organic coatings; slightly alkaline; clear smooth boundary.

Bw3—31 to 44 inches; brown (10YR 5/3) silt loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct organic coatings; slight effervescence; moderately alkaline; abrupt smooth boundary.

Bw4—44 to 54 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few very fine roots; common faint organic coatings; few fine calcium carbonate accumulations; slight effervescence; moderately alkaline; clear smooth boundary.

2C—54 to 60 inches; brown (10YR 5/3) loamy fine sand; massive; very friable; few very fine roots; few fine calcium carbonate accumulations; slight effervescence; slightly alkaline.

The mollic epipedon ranges from 10 to 24 inches in thickness. In some pedons it includes the upper part of the B horizon. The A horizon has value of 2 or 3. The Bw horizon has value of 4 or 5. The 2C horizon has value of 4 to 6 and chroma of 1 to 3.

Freeburg Series

The Freeburg series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 4 percent.

Typical pedon of Freeburg silt loam, 1 to 4 percent slopes, rarely flooded, 1,000 feet east and 1,920 feet south of the northwest corner of sec. 2, T. 46 N., R. 18 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam,

pale brown (10YR 6/3) dry; weak fine granular structure; friable; common very fine roots; few fine iron and manganese oxide accumulations; very strongly acid; abrupt smooth boundary.

E—8 to 14 inches; brown (10YR 5/3) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; many very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt—14 to 20 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; common very fine roots; few distinct clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation and grayish brown (10YR 5/2) iron depletions throughout; few fine iron and manganese oxide accumulations; many distinct silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Btg1—20 to 30 inches; yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; many fine distinct yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg2—30 to 40 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine distinct yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; very strongly acid; gradual smooth boundary.

BCg—40 to 50 inches; grayish brown (10YR 5/2) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; many fine distinct yellowish brown (10YR 5/4) and common fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; very strongly acid; gradual smooth boundary.

Cg—50 to 60 inches; grayish brown (10YR 5/2) silty clay loam; massive; firm; few very fine roots; few distinct clay films in root channels; common fine distinct yellowish brown (10YR 5/4) and common fine prominent strong brown (7.5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; strongly acid.

The Ap horizon has chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 to 4. The upper part of the Bt horizon has value of 4 or 5 and chroma of 2 to 6. The lower part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 1 to 6. The Cg horizon has value of 4 or 5 and chroma of 1 or 2. It has mottles with higher chroma.

Glensted Series

The Glensted series consists of very deep, poorly drained, slowly permeable soils on uplands. These soils formed in loess and in the underlying limestone residuum. Slopes range from 2 to 5 percent.

Typical pedon of Glensted silt loam, 2 to 5 percent slopes, eroded, 150 feet west and 2,400 feet south of the northeast corner of sec. 34, T. 46 N., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, dark brown (10YR 4/3) dry; weak fine granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

Btg1—8 to 14 inches; dark grayish brown (10YR 4/2) silty clay; strong fine subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; many fine prominent red (2.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; moderately acid; clear smooth boundary.

2Btg2—14 to 22 inches; grayish brown (2.5Y 5/2) and brown (10YR 5/3) silty clay; strong fine subangular blocky structure; firm; few very fine roots; many prominent clay films on faces of peds; common fine prominent yellowish red (5YR 5/6) masses of iron accumulation throughout; the areas of brown are iron accumulations; few fine iron and manganese oxide accumulations; 2 percent fine chert gravel; slightly acid; gradual smooth boundary.

2Btg3—22 to 33 inches; light brownish gray (2.5Y 6/2) silty clay; strong very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; many fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 2 percent fine chert gravel; few distinct silt coatings on faces of peds; slightly acid; clear smooth boundary.

2Btg4—33 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; many medium

prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 5 percent fine chert gravel; slightly acid; clear smooth boundary.

2BCg—44 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common shiny pressure faces; common medium prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; 10 percent fine chert gravel; moderately acid.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Btg and 2Btg horizons have hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The content of gravel in the 2Btg horizon ranges from 2 to 15 percent.

Goss Series

The Goss series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in cherty limestone residuum. Slopes range from 3 to 45 percent.

Typical pedon of Goss gravelly silt loam, 15 to 45 percent slopes, very stony, 2,000 feet west and 200 feet south of the northeast corner of sec. 5, T. 46 N., R. 15 W.

A—0 to 4 inches; dark brown (10YR 4/3) gravelly silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many very fine roots; 10 percent chert gravel, 5 percent chert cobbles, 1 percent chert stones; strongly acid; clear smooth boundary.

E1—4 to 14 inches; yellowish brown (10YR 5/4) very gravelly silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; many medium roots; 30 percent chert gravel, 5 percent chert cobbles, 5 percent chert stones; common distinct silt coatings; very strongly acid; clear smooth boundary.

E2—14 to 21 inches; brown (7.5YR 5/4) very gravelly silt loam; weak medium platy structure parting to moderate fine subangular blocky; firm; many medium roots; 35 percent chert gravel, 10 percent chert cobbles, 10 percent chert stones; many prominent silt coatings; very strongly acid; gradual smooth boundary.

BE—21 to 29 inches; strong brown (7.5YR 4/6) very gravelly silt loam; strong medium subangular blocky structure; firm; common very fine roots; 35 percent chert gravel, 10 percent chert cobbles, 10 percent chert stones; common prominent silt coatings; very strongly acid; gradual smooth boundary.

2Bt1—29 to 44 inches; yellowish red (5YR 4/6) and dark red (2.5YR 3/6) very gravelly clay; strong very fine angular blocky structure; very firm; common fine roots; common prominent clay films on faces of peds; 30 percent chert gravel, 10 percent chert stones; very strongly acid; gradual smooth boundary.

2Bt2—44 to 60 inches; dark red (2.5YR 3/6) gravelly clay; strong very fine angular blocky structure; very firm; common very fine roots; common prominent clay films on faces of peds; 30 percent chert gravel; very strongly acid.

Stones cover 0.1 to 3.0 percent of the surface in areas where slopes are more than 15 percent. The content of gravel ranges from 0 to 65 percent, the content of cobbles ranges from 0 to 30 percent, and the content of stones ranges from 0 to 15 percent. The A horizon has value of 3 or 4 and chroma of 2 to 4. It dominantly is gravelly silt loam or silt loam. The E horizon has hue of 7.5YR or 10YR and value of 4 or 5. It dominantly is very gravelly silt loam, but the range includes silt loam. The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 to 8. It is gravelly to extremely gravelly silty clay loam, silty clay, or clay.

Grable Series

The Grable series consists of very deep, well drained, moderately permeable soils on the flood plain along the Missouri River. These soils formed in calcareous alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Grable silt loam, loamy substratum, occasionally flooded, 2,800 feet north and 4,250 feet east of the southwest corner of sec. 2, T. 48 N., R. 15 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—6 to 23 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) layers of silt loam; few thin strata of brown (10YR 5/3) very fine sandy loam; massive; very friable; few very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2C2—23 to 39 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) layers of fine sand; few thin strata of brown (10YR 5/3) very fine sandy loam; massive; loose; few very fine roots; strongly

effervescent; moderately alkaline; abrupt smooth boundary.

3C3—39 to 60 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) layers of silt loam; few thin strata of grayish brown (10YR 5/2) loamy fine sand; massive; very friable; few fine prominent dark yellowish brown (10YR 4/6) stains; strongly effervescent; moderately alkaline.

The A horizon has chroma of 1 or 2. The C horizon has value of 4 or 5. It is silt loam or very fine sandy loam. The 2C horizon has value of 4 or 5. It is fine sand or loamy fine sand. The 3C horizon has value of 4 or 5. It is silt loam or very fine sandy loam.

Haynie Series

The Haynie series consists of very deep, moderately well drained, moderately permeable soils on the flood plain along the Missouri River. These soils formed in calcareous alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Haynie silt loam, occasionally flooded, 2,500 feet north and 4,000 feet east of the southwest corner of sec. 21, T. 48 N., R. 18 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—9 to 27 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) layers of silt loam; few thin strata of silty clay loam; massive; very friable; few very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2—27 to 46 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) layers of silt loam; few thin strata of silty clay loam; massive; friable; few very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C3—46 to 60 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) layers of silt loam; few thin strata of silty clay loam; massive; friable; slightly effervescent; moderately alkaline.

The A horizon has hue of 10YR or 2.5Y. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. In some pedons the C horizon has mottles with hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 8. It is silt loam or very fine sandy loam. Strata of coarser and finer materials are in some pedons.

Higginsville Series

The Higginsville series consists of very deep, somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 5 percent.

Typical pedon of Higginsville silt loam, 2 to 5 percent slopes, 100 feet south and 1,950 feet east of the northwest corner of sec. 14, T. 49 N., R. 19 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many very fine roots; neutral; abrupt smooth boundary.

A—9 to 20 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; common very fine roots; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

Btg1—20 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; many distinct organic stains on faces of peds; slightly acid; gradual smooth boundary.

Btg2—27 to 38 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; common prominent clay films on faces of peds; many fine prominent yellowish brown (10YR 5/4) and few fine faint grayish brown (10YR 5/2) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Btg3—38 to 47 inches; grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; the areas of yellowish brown are iron accumulations; moderately acid; gradual smooth boundary.

Btg4—47 to 60 inches; grayish brown (10YR 5/2) silty clay loam; weak fine subangular blocky structure; few very fine roots; common distinct clay films on faces of peds; many fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; moderately acid.

The thickness of the mollic epipedon ranges from 10 to more than 24 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3.

The C horizon, if it occurs, has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silt loam.

Jemerson Series

The Jemerson series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 2 to 5 percent.

Typical pedon of Jemerson silt loam, 2 to 5 percent slopes, rarely flooded, 1,800 feet west and 2,300 feet south of the northeast corner of sec. 14, T. 47 N., R. 18 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few very fine roots; neutral; abrupt smooth boundary.

BE—9 to 16 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few very fine roots; few faint clay films on faces of peds; common distinct silt coatings on faces of peds; neutral; clear smooth boundary.

Bt1—16 to 26 inches; dark brown (7.5YR 4/4) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common prominent silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt2—26 to 36 inches; dark brown (7.5YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt3—36 to 46 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; few prominent silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt4—46 to 55 inches; dark brown (7.5YR 4/4) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; gradual smooth boundary.

BC—55 to 60 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; firm; few distinct clay films in root channels; few fine distinct strong brown (7.5YR 4/6) masses of iron accumulation; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid.

The Ap horizon has chroma of 2 or 3. The Bt and BC horizons have value of 3 or 4. They are silty clay loam or silt loam.

Knox Series

The Knox series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 9 percent.

Typical pedon of Knox silt loam, 3 to 9 percent slopes, eroded, 500 feet west and 1,200 feet north of the southeast corner of sec. 21, T. 48 N., R. 19 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

Bt1—8 to 17 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; common very fine roots; few distinct clay films on faces of peds; common distinct organic coatings; neutral; clear smooth boundary.

Bt2—17 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; common very fine roots; many prominent clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—27 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common prominent clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt4—40 to 48 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; slightly acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; firm; few very fine roots; few prominent clay films in root channels; slightly acid.

The Ap horizon has chroma of 2 or 3. The Bt and C horizons have value of 4 or 5. They are silty clay loam or silt loam.

Ladoga Series

The Ladoga series consists of very deep, moderately well drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 9 percent.

Typical pedon of Ladoga silt loam, 3 to 9 percent slopes, eroded, 1,250 feet north and 100 feet east of

the southwest corner of sec. 17, T. 48 N., R. 20 W., in Saline County, Missouri:

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; friable; common very fine roots; common distinct dark brown clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—17 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few black organic stains; many distinct clay films on faces of peds; moderately acid; clear smooth boundary.

Bt3—23 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; few black organic stains; few distinct clay films on faces of peds; few fine distinct grayish brown (10YR 5/2) iron depletions throughout; moderately acid; clear smooth boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; firm; few very fine roots; few distinct strong brown stains; few distinct clay films on vertical cleavage faces; few fine distinct grayish brown (10YR 5/2) iron depletions throughout; few fine iron and manganese concretions; moderately acid.

The A horizon has value of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silty clay. The C horizon has colors similar to those in the B horizon. It is silt loam or silty clay loam.

Leslie Series

The Leslie series consists of very deep, somewhat poorly drained and poorly drained, slowly permeable soils on uplands and high terraces. These soils formed in loess. Slopes range from 0 to 5 percent.

Typical pedon of Leslie silt loam, 1 to 3 percent slopes, 1,200 feet west and 2,300 feet south of the northeast corner of sec. 25, T. 47 N., R. 18 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

Eg—11 to 16 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; common distinct silt coatings on faces of peds; common distinct organic stains; neutral; clear smooth boundary.

Btg1—16 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common prominent silt coatings on faces of peds; moderately acid; clear smooth boundary.

Btg2—20 to 30 inches; dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/6) silty clay; strong very fine subangular blocky structure; firm; few very fine roots; many prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; the areas of yellowish brown are iron accumulations; moderately acid; gradual smooth boundary.

Btg3—30 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; many fine prominent yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid; gradual smooth boundary.

Btg4—40 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

BCg—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; weak medium subangular blocky structure; firm; common fine prominent dark yellowish brown (10YR 4/4) and strong brown (7.5YR 5/6) masses of iron accumulation throughout; neutral.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The upper part of the Btg horizon has value of 4 to 6 and chroma of 1 or 2. The lower part has hue of 10YR or 2.5Y. The BCg horizon has colors similar to those in the Btg horizon. It is silty clay loam or silt loam. The C horizon, if it occurs, has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Leta Series

The Leta series consists of very deep, somewhat poorly drained soils on the flood plain along the Missouri River. These soils formed in 20 to 38 inches of clayey alluvium over silty alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Leta silty clay loam, occasionally flooded, 2,500 feet west and 1,200 feet north of the southeast corner of sec. 3, T. 48 N., R. 15 W.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; firm; few very fine roots; neutral; abrupt smooth boundary.

A—12 to 18 inches; very dark grayish brown (10YR 3/2) silty clay; strong very fine angular blocky structure; very firm; few very fine roots; common pressure faces; many prominent organic coatings; neutral; clear smooth boundary.

Bg—18 to 26 inches; dark grayish brown (10YR 4/2) silty clay; strong fine angular blocky structure; very firm; few very fine roots; common pressure faces; few distinct organic coatings; neutral; abrupt smooth boundary.

2Cg1—26 to 39 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) layers of silt loam; common thin strata of very dark grayish brown (10YR 3/2) silty clay loam; massive; very friable; few very fine roots; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; slightly alkaline; gradual smooth boundary.

2Cg2—39 to 60 inches; grayish brown (10YR 5/2) silt loam; massive; very friable; few very fine roots; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine calcium carbonate accumulations; slightly effervescent; slightly alkaline.

The mollic epipedon ranges from 10 to 24 inches in thickness. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon is silty clay loam or silty clay. The 2C horizon has value of 4 to 6. It commonly is stratified silt loam and very fine sandy loam but may have thin layers of finer or coarser material.

Lindley Series

The Lindley series consists of very deep, well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till sediments. Slopes range from 14 to 35 percent.

Typical pedon of Lindley silt loam, 14 to 35 percent slopes, 2,000 feet east and 1,500 feet south of the northwest corner of sec. 11, T. 49 N., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common very fine roots; few distinct organic coatings; slightly acid; abrupt smooth boundary.

E—5 to 12 inches; brown (10YR 5/3) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; common very fine roots; few distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

2Bt1—12 to 23 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; 1 percent gravel; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

2Bt2—23 to 33 inches; strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; 2 percent gravel; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

2Bt3—33 to 43 inches; strong brown (7.5YR 4/6) loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine prominent grayish brown (10YR 5/2) iron depletions and yellowish red (5YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 2 percent gravel; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

2BC—43 to 60 inches; strong brown (7.5YR 4/6) and yellowish red (5YR 5/8) loam; weak coarse prismatic structure; firm; few very fine roots; few fine prominent grayish brown (10YR 5/2) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; 2 percent gravel; few distinct silt coatings on faces of peds; strongly acid.

The A horizon has value of 3 or 4 and chroma of 1 or 2. The E horizon has value of 5 or 6 and chroma of 2 to 4. The Bt and BC horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8.

McGirk Series

The McGirk series consists of very deep, poorly drained, slowly permeable soils on uplands. These soils

Figure 19.—Profile of Bluelick silt loam, 15 to 25 percent slopes, eroded.

Figure 20.—Profile of Dameron silt loam, 0 to 3 percent slopes, occasionally flooded.

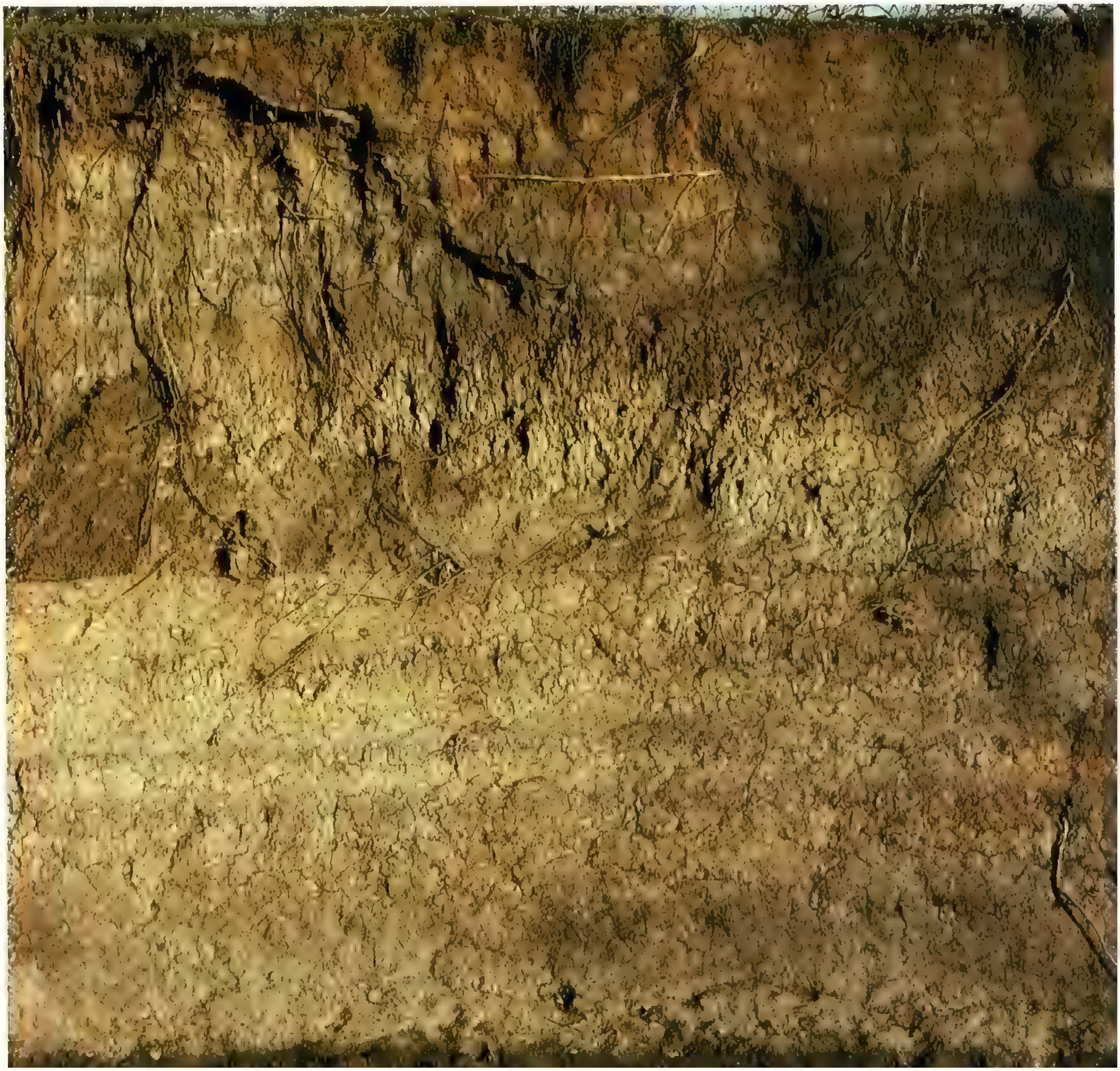

Figure 21.—Profile of Dockery silt loam, frequently flooded.

Figure 22.—Profile of Moko very flaggy loam.

formed in colluvium and local alluvium. Slopes range from 2 to 5 percent.

Typical pedon of McGirk silt loam, 2 to 5 percent slopes, 1,420 feet south and 900 feet west of the northeast corner of sec. 20, T. 46 N., R. 16 W.

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common very fine roots; neutral; abrupt smooth boundary.

Eg—7 to 12 inches; light brownish gray (10YR 6/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few very fine roots; few distinct silt coatings; neutral; clear smooth boundary.

BEg—12 to 17 inches; light brownish gray (10YR 6/2) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; common distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg1—17 to 22 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg2—22 to 32 inches; grayish brown (2.5Y 5/2) silty clay; moderate very fine subangular blocky structure; very firm; many distinct clay films on faces of peds; common fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Btg3—32 to 50 inches; light brownish gray (2.5Y 6/2) silty clay loam; moderate fine subangular blocky structure; very firm; few very fine roots; few distinct clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/6) and few fine prominent yellowish brown (10YR 5/8) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Btg4—50 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct clay films on faces of peds; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; slightly acid.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has hue of 10YR or 2.5Y and value of 6 or 7. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Menfro Series

The Menfro series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 35 percent.

Typical pedon of Menfro silt loam, 3 to 9 percent slopes, eroded, 900 feet south and 100 feet east of the northwest corner of sec. 17, T. 49 N., R. 18 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; common very fine roots; many distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—12 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—22 to 31 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt4—31 to 38 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt5—38 to 49 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; moderately acid; gradual smooth boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few very fine roots; few distinct clay films in root channels; moderately acid.

The Ap horizon has value of 3 or 4 and chroma of 2

or 3. The E horizon, if it occurs, has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

Moko Series

The Moko series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in limestone residuum. Slopes range from 3 to 45 percent.

Typical pedon of Moko very flaggy loam (fig. 22), in an area of Moko-Rock outcrop complex, 8 to 45 percent slopes, 1,300 feet west and 500 feet north of the southeast corner of sec. 23, T. 47 N., R. 18 W.

A1—0 to 3 inches; black (10YR 2/1) very flaggy loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; many medium roots; 30 percent limestone flagstones; 10 percent chert gravel; slightly alkaline; gradual smooth boundary.

A2—3 to 9 inches; very dark gray (10YR 3/1) very flaggy silt loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; many medium roots; 39 percent limestone flagstones; 10 percent chert gravel; slightly alkaline; abrupt smooth boundary.

R—9 inches; hard bedrock.

The depth to bedrock ranges from 6 to 20 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The content of coarse fragments ranges from 30 to 75 percent.

Moniteau Series

The Moniteau series consists of very deep, poorly drained, moderately slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Moniteau silt loam, occasionally flooded, 200 feet east and 1,900 feet north of the southwest corner of sec. 26, T. 46 N., R. 19 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few very fine roots; few fine iron and manganese oxide accumulations; moderately acid; abrupt smooth boundary.

Eg—10 to 19 inches; grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) silt loam; weak medium platy structure parting to weak fine granular; friable; few very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common prominent silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg1—19 to 28 inches; grayish brown (10YR 5/2) silty clay loam; weak very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg2—28 to 42 inches; grayish brown (10YR 4/2), gray (5Y 5/1), and dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; the areas of dark yellowish brown are iron accumulations; common fine iron and manganese oxide accumulations; strongly acid; gradual smooth boundary.

Btg3—42 to 60 inches; dark gray (10YR 4/1) silty clay loam; moderate very fine subangular blocky structure; firm; few distinct clay films in root channels; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; strongly acid.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The Btg horizon and the Cg horizon, if it occurs, have hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Motark Series

The Motark series consists of very deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Motark silt loam, occasionally flooded, 1,100 feet south and 2,300 feet west of the northeast corner of sec. 9, T. 48 N., R. 15 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

C—8 to 27 inches; dark brown (10YR 4/3) silt loam; appears massive but has weak bedding planes; friable; few very fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few thin brown (10YR 5/3) strata; neutral; abrupt smooth boundary.

Cg1—27 to 42 inches; dark grayish brown (10YR 4/2)

silt loam; massive; friable; few very fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few thin dark brown (10YR 3/3) strata; neutral; abrupt smooth boundary.

Cg2—42 to 55 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; few very fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few thin grayish brown (10YR 5/2) strata; neutral; abrupt smooth boundary.

Cg3—55 to 60 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; massive; friable; few very fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation throughout; few thin strata of silty clay loam; neutral.

The Ap horizon has value and chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 2 or 3.

Newcomer Series

The Newcomer series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in residuum derived from sandstone and thin beds of shale. Slopes range from 9 to 35 percent.

Typical pedon of Newcomer silt loam, 14 to 35 percent slopes, 2,100 feet north and 350 feet east of the southwest corner of sec. 2, T. 48 N., R. 17 W.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many medium roots; neutral; clear smooth boundary.

E—8 to 14 inches; dark brown (10YR 4/3) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; common medium roots; common distinct silt coatings; slightly acid; gradual smooth boundary.

2Bt—14 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; common medium roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; 10 percent sandstone fragments; few distinct silt coatings; strongly acid; clear smooth boundary.

2Cr—24 to 60 inches; sandstone.

The A horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or loam.

Pershing Series

The Pershing series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Pershing silt loam, 2 to 5 percent slopes, 2,525 feet north and 2,300 feet east of the southwest corner of sec. 12, T. 47 N., R. 16 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many very fine roots; slightly acid; abrupt smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; common very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; many distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

BE—14 to 20 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; common very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

Btg1—20 to 27 inches; dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; many prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; the areas of dark yellowish brown are iron accumulations; strongly acid; gradual smooth boundary.

Btg2—27 to 36 inches; dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), and dark yellowish brown (10YR 4/6) silty clay; strong fine subangular blocky structure; firm; few very fine roots; many prominent clay films on faces of peds; few fine iron and manganese oxide accumulations; the areas of yellowish brown and dark yellowish brown are iron accumulations; moderately acid; gradual smooth boundary.

Btg3—36 to 46 inches; grayish brown (10YR 5/2), yellowish brown (10YR 5/4), and dark yellowish brown (10YR 4/6) silty clay loam; weak very fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; the areas of yellowish brown and dark yellowish brown are iron accumulations; slightly acid; gradual smooth boundary.

Btg4—46 to 60 inches; grayish brown (10YR 5/2) silty clay loam; weak fine subangular blocky structure;

firm; few very fine roots; few distinct clay films on faces of peds; many fine prominent yellowish brown (10YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid.

The Ap horizon has chroma of 2 or 3. The E and BE horizons have value of 4 or 5 and chroma of 2 or 3. The Bt and Btg horizons have value of 4 or 5 and chroma of 2 to 6. They are silty clay loam or silty clay.

Sarpy Series

The Sarpy series consists of very deep, excessively drained, rapidly permeable soils on the flood plain along the Missouri River. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Sarpy fine sand, occasionally flooded, 1,050 feet east and 900 feet south of the northwest corner of sec. 11, T. 48 N., R. 15 W.

Ap—0 to 6 inches; brown (10YR 5/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; common very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—6 to 20 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) layers of fine sand; single grain; loose; few very fine roots; few thin dark grayish brown (10YR 4/2) strata; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2—20 to 60 inches; pale brown (10YR 6/3) fine sand; single grain; loose; few very fine roots; few thin dark grayish brown (10YR 4/2) strata; slightly effervescent; moderately alkaline.

The A horizon has value of 3 to 5 and chroma of 2 or 3. The C horizon has value of 4 to 6 and chroma of 2 or 3.

Shannondale Series

The Shannondale series consists of very deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Shannondale silt loam, rarely flooded, 1,300 feet north and 3,050 feet east of the southwest corner of sec. 23, T. 46 N., R. 17 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

A—9 to 19 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.

Bt—19 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; common very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide accumulations and stains; common distinct organic coatings; neutral; gradual smooth boundary.

Btg1—24 to 37 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct organic coatings; slightly acid; gradual smooth boundary.

Btg2—37 to 47 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) and few fine prominent dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

Btg3—47 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct clay films in root channels; many fine distinct dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; neutral.

The thickness of the mollic epipedon ranges from 10 to 24 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizons have value of 4 or 5 and chroma of 2 to 4.

Speed Series

The Speed series consists of very deep, somewhat poorly drained, moderately permeable soils on high flood plains and toe slopes. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Speed silt loam, 0 to 2 percent slopes, occasionally flooded, about 2,850 feet south and 120 feet east of the northwest corner of sec. 14, T. 46 N., R. 18 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak

fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many very fine roots; few distinct iron and manganese oxide stains; moderately acid; clear smooth boundary.

Eg1—14 to 20 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; common very fine roots; few fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few distinct iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; common distinct organic coatings; strongly acid; clear smooth boundary.

Eg2—20 to 27 inches; grayish brown (10YR 5/2) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few very fine roots; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few distinct iron and manganese oxide stains; many prominent silt coatings on faces of peds; strongly acid; clear smooth boundary.

Btg1—27 to 31 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; many distinct silt coatings on faces of peds; few distinct organic stains; very strongly acid; gradual smooth boundary.

Btg2—31 to 35 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Btg3—35 to 48 inches; dark grayish brown (10YR 4/2) silt loam; moderate very fine subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; many fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Btg4—48 to 60 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; weak fine subangular blocky structure; firm; common distinct clay films on faces of peds; few very fine roots; many fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings in root channels; moderately acid.

The Ap and A horizons have value of 2 or 3 and chroma of 1 to 3. The E horizon has hue of 10YR or 2.5YR, value of 3 to 6, and chroma of 1 or 2. The Btg horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4.

Sturkie Series

The Sturkie series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Sturkie silt loam, frequently flooded, 200 feet south and 825 feet east of the northwest corner of sec. 21, T. 48 N., R. 19 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

A1—10 to 23 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common very fine roots; few distinct organic coatings; neutral; clear smooth boundary.

A2—23 to 30 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few very fine roots; common distinct organic coatings; neutral; clear smooth boundary.

Bw1—30 to 40 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; few very fine roots; few faint silt coatings; neutral; gradual smooth boundary.

Bw2—40 to 50 inches; dark brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; few faint silt coatings; neutral; gradual smooth boundary.

C—50 to 60 inches; dark brown (10YR 4/3) silt loam; massive; friable; few very fine roots; few thin grayish brown (10YR 5/2) strata; slightly acid.

The Ap horizon has chroma of 2 or 3. The Bw and C horizons have value of 4 or 5 and chroma of 3 or 4.

Wakenda Series

The Wakenda series consists of very deep, well drained, moderately permeable soils on uplands. These

soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Wakenda silt loam, 2 to 5 percent slopes, 1,350 feet south and 675 feet west of the northeast corner of sec. 13, T. 48 N., R. 18 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

A—10 to 19 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.

Bt1—19 to 26 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; common distinct organic coatings; neutral; gradual smooth boundary.

Bt2—26 to 41 inches; brown (10YR 4/3) silty clay loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

Bt3—41 to 45 inches; yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) silty clay loam; few fine distinct dark yellowish brown (10YR 4/6), brown (10YR 5/3), and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; neutral; clear smooth boundary.

Cg—45 to 60 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) silty clay loam; massive; firm; few very fine roots; common fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) masses of iron accumulation throughout; few very fine iron and manganese oxide accumulations; slightly acid.

The thickness of the mollic epipedon ranges from 16 to 24 inches. The A horizon has value and chroma of 2 or 3. The Bt horizon has value of 3 to 5 and chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 2 to 4. It commonly is silty clay loam, but in some pedons it is silt loam.

Waldron Series

The Waldron series consists of very deep, somewhat poorly drained, slowly permeable soils on the flood plain along the Missouri River. These soils formed in calcareous alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Waldron silty clay loam, loamy substratum, occasionally flooded, 1,100 feet south and 4,300 feet east of the northwest corner of sec. 7, T. 49 N., R. 18 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; few very fine roots; slightly alkaline; abrupt smooth boundary.

Cg1—9 to 21 inches; dark grayish brown (2.5Y 4/2) and very dark gray (10YR 3/1) layers of silty clay loam; appears massive but has weak bedding planes; firm; few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; common thin strata of silty clay; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Cg2—21 to 37 inches; very dark gray (10YR 3/1) silty clay loam; massive; firm; few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few thin strata of grayish brown (10YR 5/2) silt loam; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Cg3—37 to 48 inches; dark grayish brown (2.5Y 4/2) and very dark gray (10YR 3/1) layers of silty clay loam; appears massive but has weak bedding planes; firm; few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few thin strata of silt loam; slightly effervescent; slightly alkaline; abrupt smooth boundary.

2Cg4—48 to 60 inches; dark grayish brown (2.5Y 4/2) and very dark gray (10YR 3/1) layers of silt loam; appears massive but has weak bedding planes; firm; few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; slightly effervescent; slightly alkaline.

The Ap horizon has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or 2. The C and Cg horizons have hue of 10YR or 2.5Y or are neutral in hue. They have value of 2 to 5 and chroma of 0 to 4. They contain strata of silt loam and very fine sandy loam. Thin lenses of coarser textures are in the control section.

Weller Series

The Weller series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 14 percent.

Typical pedon of Weller silt loam, 2 to 5 percent slopes, 2,500 feet north and 1,250 feet east of the southwest corner of sec. 9, T. 47 N., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many very fine roots; few fine iron and manganese oxide accumulations; common fine iron and manganese oxide stains; neutral; abrupt smooth boundary.

E—8 to 13 inches; brown (10YR 5/3) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; common very fine roots; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

BE—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—20 to 29 inches; yellowish brown (10YR 5/4) silty clay; moderate fine subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; common fine distinct grayish brown (10YR 5/2) iron depletions and common fine distinct dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; few very fine iron and manganese oxide accumulations; few distinct silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—29 to 38 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay loam; moderate very fine subangular blocky structure; few very fine roots; common distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) and few fine distinct yellowish brown (10YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; very strongly acid; gradual smooth boundary.

Btg1—38 to 50 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) and few fine prominent yellowish brown (10YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings; strongly acid; gradual smooth boundary.

Btg2—50 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) and dark yellowish brown (10YR 4/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; slightly acid.

The Ap horizon has value of 4 or 5 and chroma of 1 to 3. The E horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 2 to 6. It is silty clay loam or silty clay.

Winfield Series

The Winfield series consists of very deep, moderately well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 14 percent.

Typical pedon of Winfield silt loam, 3 to 9 percent slopes, eroded, 2,100 feet east and 400 feet south of the northwest corner of sec. 20, T. 48 N., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; moderately acid; abrupt smooth boundary.

Bt1—8 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—18 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt3—28 to 37 inches; yellowish brown (10YR 5/4) and brown (10YR 5/3) silty clay loam; weak fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; common fine distinct grayish brown (10YR 5/2) iron depletions and yellowish brown (10YR 5/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; common distinct silt coatings on faces of peds; moderately acid; gradual smooth boundary.

Btg1—37 to 45 inches; grayish brown (10YR 5/2) silty clay loam; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent yellowish brown (10YR 5/6) and few fine prominent yellowish brown (10YR 4/6) masses of iron accumulation throughout; common fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Btg2—45 to 56 inches; grayish brown (10YR 5/2) silty

clay loam; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; moderately acid; gradual smooth boundary.

Cg—56 to 60 inches; grayish brown (10YR 5/2) silt loam; massive; firm; few very fine roots; few distinct clay films in root channels; few fine prominent strong brown (7.5YR 4/6) and yellowish brown (10YR 5/8) masses of iron accumulation throughout; few fine iron and manganese oxide accumulations; slightly acid.

The Ap horizon has chroma of 2 or 3. The E horizon, if it occurs, has value of 4 to 6 and chroma of 2 to 4. The upper part of the Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The Btg horizon has value of 4 to 6 and chroma of 1 to 6. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4.

Wrengart Series

The Wrengart series consists of very deep, moderately well drained, moderately slowly permeable soils on uplands. These soils formed in loess and in the underlying residuum derived from cherty limestone. Slopes range from 3 to 25 percent.

Typical pedon of Wrengart silt loam, 3 to 8 percent slopes, eroded, 3,700 feet north and 1,010 feet west of the southeast corner of sec. 4, T. 47 N., R. 17 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many very fine roots; few distinct organic coatings; neutral; abrupt smooth boundary.

Bt1—6 to 9 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; many very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; few faint silt coatings; neutral; clear smooth boundary.

Bt2—9 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; common very fine roots; common distinct clay films on faces of peds; few fine iron and manganese oxide accumulations; few distinct silt coatings; moderately acid; gradual smooth boundary.

Bt3—16 to 26 inches; dark yellowish brown (10YR 4/6) silty clay loam; strong very fine subangular blocky structure; firm; common very fine roots; many distinct clay films on faces of peds; few fine distinct grayish brown (10YR 5/2) iron depletions throughout; few fine iron and manganese oxide accumulations; few distinct silt coatings; moderately acid; gradual smooth boundary.

Btx1—26 to 34 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; few fine distinct dark yellowish brown (10YR 4/6) iron depletions throughout; few fine iron and manganese oxide stains; 50 percent weak brittleness; common distinct silt coatings; moderately acid; gradual smooth boundary.

Btx2—34 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure; very firm; few very fine roots; common distinct clay films on vertical faces of peds; few fine iron and manganese oxide stains; 55 percent weak brittleness; few prominent silt coatings; moderately acid; clear smooth boundary.

2Bt1—45 to 60 inches; yellowish brown (10YR 5/6) extremely gravelly silty clay loam; few fine distinct yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; firm; common very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide stains; many prominent silt coatings; 60 percent chert gravel, 10 percent chert cobbles, 5 percent chert stones; moderately acid; clear smooth boundary.

3Bt2—60 to 80 inches; red (2.5YR 4/6) gravelly silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; strong fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine iron and manganese oxide stains; many prominent silt coatings; 20 percent chert gravel, 5 percent chert cobbles, 5 percent chert stones; slightly acid.

The Ap horizon has chroma of 2 or 3. The E horizon, if it occurs, has value of 4 to 6 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is brittle in 15 to 60 percent of the mass. The 2Bt horizon, if it occurs, has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. The 3Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 8, and chroma of 2 to 8.

Zook Series

The Zook series consists of very deep, poorly drained, slowly permeable soils on flood plains. These

soils formed in thick deposits of alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Zook silty clay loam, occasionally flooded, 400 feet north and 2,300 feet west of the southeast corner of sec. 24, T. 48 N., R. 17 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; firm; few very fine roots; few fine iron and manganese oxide accumulations; neutral; abrupt smooth boundary.

A1—9 to 20 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; very firm; common very fine roots; few fine iron and manganese oxide accumulations; few shiny pressure faces; slightly acid; gradual smooth boundary.

A2—20 to 30 inches; black (N 2/0) silty clay, dark gray (2.5Y 4/0) dry; moderate fine subangular blocky structure; very firm; common very fine roots; common shiny pressure faces; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

A3—30 to 38 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; strong fine subangular blocky structure; very firm; few very fine roots; common shiny pressure faces; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

Bg1—38 to 46 inches; dark gray (5Y 4/1) silty clay; strong fine subangular blocky structure; very firm; few very fine roots; common shiny pressure faces; few fine iron and manganese oxide accumulations; neutral; gradual smooth boundary.

Bg2—46 to 60 inches; dark gray (5Y 4/1) silty clay; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; very firm; few very fine roots; common shiny pressure faces; few fine iron and manganese oxide accumulations; neutral.

The thickness of the mollic epipedon ranges from 36 to 50 inches. The A horizon has value of 2 or 3 and chroma of 0 or 1. The Bg horizon has hue of 10YR to 5Y and value of 2 to 5.

Formation of the Soils

Soil is the product of soil-forming processes acting on accumulated or deposited geologic materials. The characteristics of the soil are determined by the type of parent material; biological activity on and in the soil; the climate under which the soil-forming factors were active; relief, or lay of the land; and the length of time these forces have been active.

The parent material affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Plant and animal life are the active factors of soil formation. The climate determines the amount of water available for leaching and the amount of heat for physical and chemical changes. Together, climate and plant and animal life act on the parent material and slowly change it to a natural body that has genetically related horizons. Relief often modifies these other factors. Finally, time is required for changes in the parent material to result in the formation of a soil. Generally, a long time is required for the development of distinct soil horizons.

These factors of soil formation are all so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified for the others. Soil formation is complex, and many processes of soil development are still unknown.

Parent Material

Parent material is the unconsolidated mass in which soil is formed. The formation or the deposition of this material is the first step in the development of a soil profile. The characteristics of the material determine the chemical and mineralogical composition of the soil, particularly the amount of sand, silt, clay, and rock fragments in the soil and the soil's natural fertility. For example, Newcomer soils, which formed in sandstone residuum, have a higher content of sand than Menfro soils, which formed in loess. In Cooper County, three main types of parent material, alone or in combinations of two or more, have contributed to the formation of the soils. These three kinds of parent material are loess, or material deposited by the wind; alluvium, or material deposited by water; and residuum, which is material weathered from bedrock.

Loess consists mainly of silt and clay particles that were deposited by the wind after the continental glaciers retreated or during interglacial periods. These particles were picked up by the wind along the major rivers and then deposited on the adjacent uplands. In Cooper County the loess is about 20 feet thick on the summits adjacent to the Missouri River. Soils that formed in loess include Menfro and Wakenda soils. The loess gradually thins toward the southern part of the county. It is thin or does not occur at all in the steeper areas. Many soils formed in 2 or 3 feet of loess and in the underlying parent material, generally gravelly residuum. Bluelick soils are examples.

Alluvium consists of a mixture of sand, silt, clay, and gravel particles that are sorted by water. The faster the water is flowing, the larger the particle it can carry. As the velocity of the stream slows down, the largest particles generally are deposited first. Thus, sand and silt are deposited where the water first begins to slow down, generally close to the natural channel. Haynie and Sarpy soils formed in this kind of deposit. The smaller clay particles tend to stay in suspension until the water has slowed or has stopped for several days or longer. Therefore, the soils that have the highest content of clay are in the old abandoned channels and backswamps adjacent to the uplands. Darwin soils are examples. As the streams and rivers meander and develop new flood plains at lower levels, terraces are left as remnants of the original flood plain. Leslie soils formed in alluvium on terraces.

Residuum is material derived from the weathering of bedrock. The downcutting of streams left the bedrock exposed. The bedrock has weathered for hundreds of thousands of years. In Cooper County the residuum was derived from sandstone and cherty limestone. Goss and Eldon soils formed in cherty limestone residuum. In some areas, water moving through limestone bedrock created caves, which have collapsed and left small depressions on the earth's surface. These depressions are called sinkholes. They result in a karst topography. This type of topography is prominent

in the southeastern part of the county.

Biological Activity

Biological activity refers to the action of plants and animals that affect soil development. Living organisms from micro-organisms to human beings are included.

Soil structure is altered by the growth of the roots of higher plants, which break up aggregates within the soil profile. Microflora, such as bacteria, fungi, and actinomycetes, are the primary agents of decomposition of plant roots and surface residue, such as fallen leaves, dead plants and animals, and animal waste. This decomposition involves the breakdown and conversion of raw organic matter to complex organic compounds and the production of humus (Buckman and Brady, 1969).

Humus is resistant to further microbial change. It has significant influences on many soil properties. Humus-rich soils are dark brown or black, have strong granular structure, and are characterized by enhanced natural fertility. Humus retains plant nutrients, such as nitrogen, phosphorus, and sulfur, and has a high available water capacity (Buckman and Brady, 1969).

Other organisms involved in soil formation include microfauna, such as nematodes and protozoa, and macrofauna, such as centipedes, earthworms, insects, and, to a lesser degree, rodents. Microfauna feed on microflora and parasitically on higher plants. Thus, they affect the degree and complexity of vegetative decomposition. Macrofauna contribute to organic matter conversions in many ways. They physically break up plant residues into smaller components, thereby accelerating the production of humus (Buckman and Brady, 1969).

Earthworms are particularly important in this process. In addition to the soil mixing that results from their movements, the tunnels they produce enhance the aeration of the soil and the percolation of water through the soil.

The development of a soil profile varies considerably, depending on the type of vegetation that grows on the soil. In Cooper County, differences between soils that formed under forest vegetation and soils that formed under prairie vegetation are noticeable.

In soils that formed under forest vegetation, most of the organic matter is concentrated at the surface, where a litter of fallen leaves and other debris is continually decomposing and being replenished. This thin outer layer produces strong natural acids which, when percolated downward in the soil, break down minerals and organic matter. This process accelerates leaching in the subsurface layer and thus lowers the natural fertility in that zone. The clays tend to accumulate in a lower layer, called an argillic horizon (USDA, 1975). Cotton and Menfro soils formed under forest vegetation.

In areas that supported grasses, a high concentration of fibrous roots was within a few feet of the surface. These roots tend to grow rapidly and then die, providing a large resource for the production of humus in that zone. Without the acid leachate of forest litter, minerals and organic matter tend to remain within the root zone. Consequently, the topsoil is very dark, natural fertility and the water-holding capacity are high, and the leaching of clays is slowed by highly mobile biological activity (Buckman and Brady, 1969). Higginsville and Wakenda soils have such an upper layer, known as a mollic epipedon (USDA, 1975), in the profile.

Human activity has had an immediate and great impact on soil characteristics. Large areas of forest and native prairie have been cleared and plowed for pasture and row crops. The effect of these activities is an alteration of the biological activity of the soil. Almost always, this means a reduction in organic matter content resulting from the effects of erosion and crop removal. Better aeration increases the rate of oxidation of organic matter. If topsoil is removed, the subsoil is mixed with the remaining surface layer. Tilth is reduced, and the soil is difficult to work.

Climate

Climate influences the amount and types of biological activity and determines moisture and temperature, which affect the rate of soil development. The rate of weathering of parent material varies with temperature and moisture fluctuations from day to day and from year to year. These factors also determine the types of living organisms that occur and the rate at which organic matter accumulates.

Climate can also determine the type of parent material in an area. The introduction of loess during glacial periods is an example. The type and extent of alluvial deposits are influenced by river flows, which are in turn influenced by climate.

In historic times, the prevailing climate has been temperate. Wide variations in temperature occurred between winter and summer. There have been times of drought and times of high precipitation. The native vegetation under these climate conditions was a mosaic of prairie and forest environments that competed vigorously with each other for available space. At the time the early settlers arrived in the area and altered the native vegetation, a shift toward a wetter climate was occurring that favored the growth of forest vegetation.

Under the present climate, soil moisture tends to fluctuate seasonally. This fluctuation is typically characterized by dry periods during the late summer and early fall and some degree of wetness during the rest of the year. These conditions result in the leaching of silicate clays, which accumulate in the form of films on the surface of aggregates in the subsoil. This clay accumulation, called an argillic horizon, is common in the upland soils of the county.

Relief

Relief modifies the effects of the other soil-forming processes. Various geologic forces have brought about a diverse landscape in Cooper County. Consequently, there is a broad range in shape and orientation of landforms. These factors influence soil formation in several ways.

In sloping areas, water tends to run downhill rather than to infiltrate into the soil, thereby inhibiting soil formation and accelerating geologic erosion. Thus, the soils on the steeper back slopes are typically more eroded and shallower over gravel layers, if any are present, than the soils on summits. Crestmeade soils, for example, have about 6 feet of loess and are on broad summits in the uplands. The adjacent Clafork soils are on back slopes. They have a much thinner layer of loess over gravelly residuum. The loess is thinner because of its position on the landscape. Farther downslope, Eldon and Goss soils have no loess and are gravelly throughout.

Soil porosity and drainage are also affected by the shape of the landform. Wakenda and Higginsville soils both formed in deep loess but differ in internal drainage. Wakenda soils are on convex summits and are well drained. The adjacent Higginsville soils are on linear summits and are somewhat poorly drained.

Time

Time influences the degree of development of a soil profile. Horizon development is generally a very slow process. The appearance of the soil profile is affected by how long the parent material has been in place.

The stage of development depends in part on when soil formation began. Initiation of a soil-forming cycle is associated with exposure of the parent material to biological processes. This exposure may occur because of deposition or because of rapid erosion. The most well developed, or mature, soils in Cooper County are Goss and Eldon soils. These soils formed in limestone residuum. Their development dates back to interglacial periods when the climate was similar to that of the present or was warmer. The red colors and the depth of clay accumulation in the profile of these soils are indications of the high degree of mineral weathering and soil development that have taken place.

Other soils in Cooper County began forming at the time of retreat of the last glacial period, when loess was deposited in the area. The time of deposition is thought to be about 10,000 to 20,000 years ago. Soils that began forming at this time include Menfro, Arisburg, and Weller soils. These soils have a distinct argillic horizon, but they have not undergone as much weathering and leaching of nutrients as the Goss and Eldon soils.

The youngest soils are in areas where the deposition of parent material is still occurring periodically during flood conditions. Dockery soils, for example, have sedimentary planes in their profile and show little or no horizon development.

The rate at which a soil forms is dependent on all of the soil-forming factors. The soil profile is the result of the interrelation and interaction of these different factors. Therefore, the appearance of the soil profile reveals the stage of development.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Back slopes in profile typically range from gently sloping to very steep and linear and descend to a foot slope. In terms of gradational process, back slopes are erosional forms produced mainly by mass wasting and running water.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landscape are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity.

The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chert. A hard, dense or compact, dull to semivitreous, cryptocrystalline sedimentary rock, consisting of cryptocrystalline silica with lesser amounts of microcrystalline or cryptocrystalline quartz and amorphous silica.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between

trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at

least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Hillslope. The steeper part of a hill between its summit and the drainage line at the base of the hill. In descending order, geomorphic components of a

simple hillslope may include shoulder, back slope, foot slope, and toe slope.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. The relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction or any elevated area between two drainageways that shed water to them.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled

by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nose slope. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. Overland flow of water is divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and

mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridge. A long, narrow elevation of the land surface, generally sharp crested with steep sides forming an extended upland between valleys.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral

fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The geomorphic component that forms the uppermost inclined surface at the top of a hillslope. It is the transition zone from the back slope to the summit of an upland area. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve (e.g., shoulder). It generally is linear along the slope width, and overland flow is parallel down the slope.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, the following slope classes are recognized:

Nearly level	0 to 1 percent
Nearly level and very gently sloping	0 to 3 percent
Very gently sloping	1 to 3 percent
Gently sloping	2 to 5 percent
Moderately sloping	5 to 9 percent
Strongly sloping	9 to 14 percent
Moderately steep	14 to 20 percent
Steep	20 to 35 percent
Very steep	more than 35 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a ridge or a hill.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in

general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water breaks (or water bars). A hump or small dike-like surface drainage structure, properly used only in closing retired roads to traffic, on firelines, or on abandoned skid trails.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1961-90 at New Franklin, Missouri)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	38.4	17.5	27.9	66	-15	25	1.33	0.36	2.19	3	2.6
February----	43.5	21.8	32.6	72	-11	50	1.40	.58	2.10	3	3.5
March-------	55.7	32.8	44.2	82	6	213	2.83	1.40	4.07	5	1.6
April-------	67.8	43.9	55.9	87	23	469	3.51	1.92	4.92	6	.1
May---------	76.5	53.6	65.0	90	34	747	4.75	2.90	6.43	7	.0
June--------	84.9	62.7	73.8	96	46	971	4.37	1.74	6.59	6	.0
July--------	89.9	67.0	78.4	101	51	1,177	3.34	1.59	4.85	5	.0
August------	88.0	64.3	76.1	101	49	1,055	3.88	1.57	5.83	5	.0
September---	81.0	56.9	69.0	96	36	821	4.19	1.83	6.21	5	.0
October-----	70.1	45.0	57.5	89	26	538	3.42	1.86	5.01	5	.0
November----	55.6	34.4	45.0	79	12	201	2.37	.94	3.72	4	.9
December----	41.9	22.7	32.3	70	-7	48	2.06	1.01	2.96	4	2.4
Yearly:											
Average---	66.1	43.6	54.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	102	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	6,316	37.45	28.11	44.60	58	11.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1961-90 at New Franklin, Missouri)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 5	Apr. 19	Apr. 28
2 years in 10 later than--	Mar. 31	Apr. 14	Apr. 23
5 years in 10 later than--	Mar. 22	Apr. 5	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 28	Oct. 15	Oct. 2
2 years in 10 earlier than--	Nov. 2	Oct. 20	Oct. 7
5 years in 10 earlier than--	Nov. 12	Oct. 30	Oct. 16

TABLE 3.--GROWING SEASON

(Recorded in the period 1961-90 at New Franklin, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	197	179	163
8 years in 10	204	185	170
5 years in 10	217	198	182
2 years in 10	230	211	194
1 year in 10	237	217	201

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10	Ackmore silt loam, occasionally flooded	1,380	0.4
11B	Arisburg silt loam, 1 to 5 percent slopes	2,520	0.7
11B2	Arisburg silt loam, 2 to 5 percent slopes, eroded	4,240	1.2
11C2	Arisburg silt loam, 5 to 9 percent slopes, eroded	3,095	0.8
13B	Jemerson silt loam, 2 to 5 percent slopes, rarely flooded	1,925	0.5
15D2	Newcomer silt loam, 9 to 14 percent slopes, eroded	135	*
15F	Newcomer silt loam, 14 to 35 percent slopes	945	0.3
17C2	Bluelick silt loam, 3 to 8 percent slopes, eroded	3,855	1.1
17D2	Bluelick silt loam, 8 to 15 percent slopes, eroded	7,550	2.1
17E2	Bluelick silt loam, 15 to 25 percent slopes, eroded	4,665	1.3
20	Bremer silt loam, occasionally flooded	2,720	0.7
25A	Chauncey silt loam, 0 to 3 percent slopes	2,930	0.8
27B	Clafork silt loam, 2 to 5 percent slopes	4,210	1.2
27B2	Clafork silt loam, 2 to 5 percent slopes, eroded	23,645	6.5
27C2	Clafork silt loam, 5 to 8 percent slopes, eroded	12,750	3.5
28A	Dameron silt loam, 0 to 3 percent slopes, occasionally flooded	7,345	2.0
29	Darwin silty clay, occasionally flooded	965	0.3
30	Dockery silt loam, frequently flooded	15,580	4.3
32A	Crestmeade silt loam, 0 to 2 percent slopes	5,190	1.4
32B2	Crestmeade silt loam, 1 to 4 percent slopes, eroded	9,005	2.5
33	Eudora loam, sandy substratum, occasionally flooded	175	*
34D	Eldon gravelly silt loam, 8 to 15 percent slopes	1,240	0.3
35A	Freeburg silt loam, 0 to 2 percent slopes, occasionally flooded	2,920	0.8
35B	Freeburg silt loam, 1 to 4 percent slopes, rarely flooded	2,705	0.7
38B2	Glensted silt loam, 2 to 5 percent slopes, eroded	535	0.1
40C	Goss silt loam, 3 to 8 percent slopes	870	0.2
40D	Goss silt loam, 8 to 15 percent slopes	3,205	0.9
40F	Goss gravelly silt loam, 15 to 45 percent slopes, very stony	30,730	8.4
41	Grable silt loam, loamy substratum, occasionally flooded	375	0.1
46	Haynie silt loam, occasionally flooded	2,440	0.7
47	Haynie-Waldron complex, occasionally flooded	1,130	0.3
48B	Higginsville silt loam, 2 to 5 percent slopes	620	0.2
50C	Bunceton silt loam, 3 to 8 percent slopes	2,350	0.6
50C2	Bunceton silt loam, 3 to 8 percent slopes, eroded	12,025	3.3
50D2	Bunceton silt loam, 8 to 15 percent slopes, eroded	970	0.3
51C2	Knox silt loam, 3 to 9 percent slopes, eroded	6,070	1.7
52C2	Ladoga silt loam, 3 to 9 percent slopes, eroded	130	*
53	Buckney fine sandy loam, occasionally flooded	150	*
54A	Leslie silt loam, terrace, 0 to 2 percent slopes	1,545	0.4
54B	Leslie silt loam, 1 to 3 percent slopes	10,525	2.9
54B2	Leslie silt loam, 2 to 5 percent slopes, eroded	14,950	4.1
56	Leta silty clay loam, occasionally flooded	1,090	0.3
60F	Lindley silt loam, 14 to 35 percent slopes	170	*
64B	McGirk silt loam, 2 to 5 percent slopes	2,065	0.6
66C	Menfro silt loam, 3 to 9 percent slopes	2,030	0.6
66C2	Menfro silt loam, 3 to 9 percent slopes, eroded	19,475	5.3
66D2	Menfro silt loam 9 to 14 percent slopes, eroded	5,515	1.5
66F	Menfro silt loam, 14 to 35 percent slopes	8,445	2.3
67C2	Menfro silt loam, karst, 3 to 9 percent slopes, eroded	1,195	0.3
70C	Moko-Rock outcrop complex, 3 to 8 percent slopes	125	*
70F	Moko-Rock outcrop complex, 8 to 45 percent slopes	2,370	0.7
72	Moniteau silt loam, occasionally flooded	3,385	0.9
75	Shannondale silt loam, rarely flooded	975	0.3
76	Motark silt loam, occasionally flooded	420	0.1
80B	Pershing silt loam, 2 to 5 percent slopes	4,275	1.2
80B2	Pershing silt loam, 2 to 5 percent slopes, eroded	5,235	1.4
80C2	Pershing silt loam, 5 to 9 percent slopes, eroded	5,355	1.5
82	Sarpy fine sand, occasionally flooded	165	*
86	Speed silt loam, 0 to 2 percent slopes, occasionally flooded	4,200	1.2
87A	Speed silt loam, 0 to 3 percent slopes, rarely flooded	1,670	0.5
88	Sturkie silt loam, frequently flooded	1,615	0.4
90B	Wakenda silt loam, 2 to 5 percent slopes	3,780	1.0

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
90C2	Wakenda silt loam, 5 to 9 percent slopes, eroded	1,380	0.4
92	Waldron silty clay loam, loamy substratum, occasionally flooded	1,405	0.4
93B	Cotton silt loam, 2 to 5 percent slopes	760	0.2
93B2	Cotton silt loam, 2 to 5 percent slopes, eroded	2,060	0.6
93C2	Cotton silt loam, 5 to 8 percent slopes, eroded	8,205	2.3
93D2	Cotton silt loam, 8 to 15 percent slopes, eroded	745	0.2
94B	Weller silt loam, 2 to 5 percent slopes	3,015	0.8
94B2	Weller silt loam, 2 to 5 percent slopes, eroded	865	0.2
94C2	Weller silt loam, 5 to 9 percent slopes, eroded	10,415	2.9
94D2	Weller silt loam, 9 to 14 percent slopes, eroded	1,220	0.3
95C	Wrengart silt loam, 3 to 8 percent slopes	3,100	0.9
95C2	Wrengart silt loam, 3 to 8 percent slopes, eroded	14,500	4.1
95D2	Wrengart silt loam, 8 to 15 percent slopes, eroded	6,520	1.8
95E	Wrengart silt loam, 15 to 25 percent slopes	2,910	0.8
96C	Winfield silt loam, 3 to 9 percent slopes	550	0.2
96C2	Winfield silt loam, 3 to 9 percent slopes, eroded	12,170	3.3
96D2	Winfield silt loam, 9 to 14 percent slopes, eroded	5,060	1.4
99	Zook silty clay loam, occasionally flooded	2,885	0.8
100	Pits, quarries	255	0.1
	Water areas more than 40 acres in size	2,320	0.6
	Total	364,205	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
10	Ackmore silt loam, occasionally flooded (where drained)
11B	Arisburg silt loam, 1 to 5 percent slopes
11B2	Arisburg silt loam, 2 to 5 percent slopes, eroded
13B	Jemerson silt loam, 2 to 5 percent slopes, rarely flooded
20	Bremer silt loam, occasionally flooded (where drained)
25A	Chauncey silt loam, 0 to 3 percent slopes (where drained)
27B	Clafork silt loam, 2 to 5 percent slopes
27B2	Clafork silt loam, 2 to 5 percent slopes, eroded
28A	Dameron silt loam, 0 to 3 percent slopes, occasionally flooded
29	Darwin silty clay, occasionally flooded (where drained)
30	Dockery silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
32A	Crestmeade silt loam, 0 to 2 percent slopes (where drained)
32B2	Crestmeade silt loam, 1 to 4 percent slopes, eroded (where drained)
33	Eudora loam, sandy substratum, occasionally flooded
35A	Freeburg silt loam, 0 to 2 percent slopes, occasionally flooded
35B	Freeburg silt loam, 1 to 4 percent slopes, rarely flooded
38B2	Glensted silt loam, 2 to 5 percent slopes, eroded (where drained)
41	Grable silt loam, loamy substratum, occasionally flooded
46	Haynie silt loam, occasionally flooded
47	Haynie-Waldron complex, occasionally flooded (where drained)
48B	Higginsville silt loam, 2 to 5 percent slopes
53	Buckney fine sandy loam, occasionally flooded
54A	Leslie silt loam, terrace, 0 to 2 percent slopes (where drained)
54B	Leslie silt loam, 1 to 3 percent slopes (where drained)
54B2	Leslie silt loam, 2 to 5 percent slopes, eroded (where drained)
56	Leta silty clay loam, occasionally flooded
64B	McGirk silt loam, 2 to 5 percent slopes (where drained)
72	Moniteau silt loam, occasionally flooded (where drained)
75	Shannondale silt loam, rarely flooded
76	Motark silt loam, occasionally flooded
80B	Pershing silt loam, 2 to 5 percent slopes
80B2	Pershing silt loam, 2 to 5 percent slopes, eroded
86	Speed silt loam, 0 to 2 percent slopes, occasionally flooded (where drained)
87A	Speed silt loam, 0 to 3 percent slopes, rarely flooded (where drained)
88	Sturkie silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
90B	Wakenda silt loam, 2 to 5 percent slopes
92	Waldron silty clay loam, loamy substratum, occasionally flooded (where drained)
93B	Cotton silt loam, 2 to 5 percent slopes
93B2	Cotton silt loam, 2 to 5 percent slopes, eroded
94B	Weller silt loam, 2 to 5 percent slopes
94B2	Weller silt loam, 2 to 5 percent slopes, eroded
99	Zook silty clay loam, occasionally flooded (where drained)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-red clover hay	Alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
10--------------- Ackmore	IIw	118	44	102	48	4.4	---	6.0
11B------------- Arisburg	IIe	125	54	113	60	4.8	3.5	6.2
11B2------------ Arisburg	IIe	118	48	105	55	4.3	3.2	6.0
11C2------------ Arisburg	IIIe	114	42	98	50	4.0	3.0	6.0
13B------------- Jemerson	IIe	108	40	94	44	3.9	3.0	5.5
15D2------------ Newcomer	VIe	---	---	---	20	1.8	---	1.6
15F------------- Newcomer	VIIe	---	---	---	---	---	---	1.3
17C2------------ Bluelick	IIIe	90	33	80	38	3.0	2.3	4.5
17D2------------ Bluelick	IVe	81	30	71	33	---	---	4.2
17E2------------ Bluelick	VIe	---	---	---	---	---	---	3.7
20-------------- Bremer	IIw	102	38	89	42	3.8	---	5.0
25A------------- Chauncey	IIw	114	41	101	48	4.3	---	5.9
27B------------- Clafork	IIe	94	35	83	38	3.5	2.6	4.7
27B2------------ Clafork	IIe	89	32	78	37	3.4	2.5	4.4
27C2------------ Clafork	IIIe	81	30	71	33	3.0	2.2	4.1
28A------------- Dameron	IIw	75	28	66	32	2.9	---	3.8
29-------------- Darwin	IIIw	87	33	75	38	---	---	4.3
30-------------- Dockery	IIIw	85	32	74	36	---	---	4.2
32A------------- Crestmeade	IIe	102	38	89	42	3.9	3.0	5.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-red clover hay	Alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
32B2------------ Crestmeade	IIIe	94	35	83	38	3.5	2.6	4.8
33-------------- Eudora	IIw	114	41	98	46	4.2	3.4	5.9
34D------------- Eldon	VIe	---	---	---	20	1.8	---	2.8
35A------------- Freeburg	IIw	108	40	94	44	---	---	4.5
35B------------- Freeburg	IIe	120	44	104	48	---	---	6.0
38B2------------ Glensted	IIIe	86	32	75	36	2.9	---	4.2
40C------------- Goss	IVe	---	21	49	23	2.1	---	3.2
40D------------- Goss	VIe	---	---	---	---	1.7	---	2.3
40F------------- Goss	VIIe	---	---	---	---	---	---	2.0
41-------------- Grable	IIw	108	38	90	42	3.9	2.9	5.5
46-------------- Haynie	IIw	100	40	95	44	4.0	3.0	5.5
47:								
Haynie---------	IIw	101	36	88	41	3.8	2.8	5.1
Waldron--------	IIw	85	30	75	33	3.2	2.4	4.2
48B------------- Higginsville	IIe	129	47	113	51	4.8	3.6	6.5
50C------------- Bunceton	IIIe	105	40	90	44	4.0	3.0	5.3
50C2------------ Bunceton	IIIe	100	37	86	41	3.7	2.7	5.0
50D2------------ Bunceton	IVe	90	32	77	36	3.3	2.4	4.5
51C2------------ Knox	IIIe	111	37	86	38	3.7	2.8	5.0
52C2------------ Ladoga	IIIe	100	37	86	38	3.7	2.8	5.0
53-------------- Buckney	IIIs	61	32	53	25	2.3	---	3.0
54A------------- Leslie	IIw	108	40	94	44	4.0	---	7.6

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-red clover hay	Alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
54B------------- Leslie	IIe	106	38	92	43	4.0	2.9	5.3
54B2------------ Leslie	IIe	96	36	85	38	3.9	2.6	4.8
56-------------- Leta	IIw	96	35	83	38	3.5	---	4.8
60F------------- Lindley	VIe	---	---	---	---	---	---	3.2
64B------------- McGirk	IIe	86	31	75	32	3.2	---	4.2
66C------------- Menfro	IIIe	101	37	88	41	3.7	2.8	5.0
66C2------------ Menfro	IIIe	94	35	83	38	3.5	2.6	4.7
66D2------------ Menfro	IIIe	82	30	72	33	3.0	2.2	4.1
66F------------- Menfro	VIe	72	26	64	29	2.7	---	3.4
67C2------------ Menfro	IIIe	94	35	83	38	3.5	2.6	4.7
70C:								
Moko-----------	VIs	---	---	---	---	---	---	1.1
Rock outcrop.								
70F:								
Moko-----------	VIIs	---	---	---	---	---	---	---
Rock outcrop.								
72-------------- Moniteau	IIIw	90	32	77	39	3.4	---	4.5
75-------------- Shannondale	I	135	50	118	55	5.0	3.5	6.8
76-------------- Motark	IIw	108	40	94	44	4.0	---	5.5
80B------------- Pershing	IIe	96	36	85	38	3.5	---	4.7
80B2------------ Pershing	IIe	92	34	80	37	3.4	---	4.6
80C2------------ Pershing	IIIe	82	31	72	34	3.0	2.2	4.1
82-------------- Sarpy	IVs	35	18	39	15	1.6	---	2.3

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-red clover hay	Alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
86-------------- Speed	IIw	102	38	89	42	3.9	---	5.1
87A------------- Speed	IIw	114	41	98	46	4.2	---	5.9
88-------------- Sturkie	IIIw	---	---	---	---	---	---	5.3
90B------------- Wakenda	IIe	126	45	110	55	4.7	4.0	6.3
90C2------------ Wakenda	IIIe	114	40	98	49	4.2	3.5	5.9
92-------------- Waldron	IIw	85	30	68	33	3.0	---	4.2
93B------------- Cotton	IIe	100	34	80	40	3.3	2.5	5.0
93B2------------ Cotton	IIe	96	31	76	38	3.0	2.4	4.8
93C2------------ Cotton	IIIe	88	29	70	35	2.7	2.1	4.6
93D2------------ Cotton	IVe	75	25	59	30	2.3	1.9	3.8
94B------------- Weller	IIe	94	35	83	38	3.5	2.6	4.7
94B2------------ Weller	IIe	89	33	78	37	3.4	2.5	4.4
94C2------------ Weller	IIIe	81	31	71	33	3.0	2.2	4.1
94D2------------ Weller	IVe	74	28	60	28	2.6	2.0	3.5
95C------------- Wrengart	IIIe	110	40	95	50	4.0	3.5	5.6
95C2------------ Wrengart	IIIe	105	38	90	48	3.8	3.3	5.3
95D2------------ Wrengart	IVe	94	35	83	42	3.5	3.1	4.7
95E------------- Wrengart	VIe	72	---	---	30	3.0	2.8	4.6
96C------------- Winfield	IIIe	108	40	94	44	4.0	3.0	5.5
96C2------------ Winfield	IIIe	102	37	89	41	3.9	2.9	5.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-red clover hay	Alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
96D2------------- Winfield	IIIe	92	34	80	37	3.4	2.6	4.6
99--------------- Zook	IIw	86	31	75	34	3.2	---	4.3
100. Pits								

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
10. Ackmore	3A	Slight	Slight	Slight	Slight	White oak	65	48	Eastern white pine, white oak, black walnut.
13B. Jemerson	3A	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak	65 60 65	48 48 48	Northern red oak, black oak, eastern white pine, green ash.
15D2. Newcomer	3A	Slight	Slight	Slight	Slight	White oak Black walnut Black oak Shagbark hickory White ash	60 --- --- --- ---	43 --- --- --- ---	White oak, white ash, yellow-poplar, sweetgum.
15F. Newcomer	3R	Moderate	Moderate	Moderate	Slight	White oak Black walnut Black oak Shagbark hickory White ash	60 --- --- --- ---	43 --- --- --- ---	White oak, white ash, yellow-poplar, sweetgum.
17C2, 17D2. Bluelick	3A	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak	60 65 62	43 48 45	White oak, green ash, black walnut.
17E2. Bluelick	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak	60 65 62	43 48 45	White oak, green ash, black walnut.
20. Bremer	7W	Slight	Severe	Moderate	Moderate	Eastern cottonwood Silver maple	90 80	103 34	Silver maple, eastern cottonwood, American sycamore, hackberry, green ash.
25A. Chauncey	4W	Slight	Severe	Moderate	Moderate	Pin oak White oak Green ash	80 --- ---	62 --- ---	Pin oak, green ash, red maple.
27B, 27B2, 27C2. Clafork	3C	Slight	Moderate	Moderate	Slight	White oak Post oak Black oak Pin oak	60 --- --- ---	43 --- --- ---	White oak, black oak.
28A. Dameron	5A	Slight	Slight	Slight	Slight	Green ash Black walnut American sycamore White oak	70 72 --- ---	66 --- --- ---	Black walnut, pecan, green ash.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
29-------------- Darwin	4W	Slight	Severe	Severe	Moderate	Pin oak------------	80	62	Eastern cottonwood, American sycamore, red maple, green ash, pin oak.
						Swamp white oak-----	---	---	
						Eastern cottonwood--	---	---	
						Green ash-----------	---	---	
						American sycamore---	---	---	
30-------------- Dockery	4W	Slight	Moderate	Slight	Slight	Pin oak-------------	76	58	Pin oak, pecan, eastern cottonwood.
33-------------- Eudora	10A	Slight	Slight	Slight	Slight	Eastern cottonwood--	105	141	Eastern cottonwood, green ash, black walnut.
						American sycamore---	---	---	
						Hackberry-----------	---	---	
						Black walnut--------	---	---	
						Green ash-----------	---	---	
35A, 35B-------- Freeburg	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	White oak, pin oak, green ash, eastern cottonwood, yellow-poplar, black oak, pecan.
40C, 40D-------- Goss	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	Black oak, white oak.
						Post oak------------	---	---	
						Black oak-----------	---	---	
						Northern red oak----	54	38	
40F------------- Goss	3R	Slight	Moderate	Moderate	Slight	White oak-----------	54	38	Black oak, white oak.
						Post oak------------	---	---	
						Black oak-----------	56	39	
						Northern red oak----	54	38	
46-------------- Haynie	11A	Slight	Slight	Slight	Slight	Eastern cottonwood--	110	156	Black walnut, eastern cottonwood.
						American sycamore---	110	156	
						Black walnut--------	---	---	
						Green ash-----------	---	---	
47:									
Haynie---------	11A	Slight	Slight	Slight	Slight	Eastern cottonwood--	110	156	Black walnut, eastern cottonwood.
						American sycamore---	110	156	
						Black walnut--------	---	---	
						Green ash-----------	---	---	
Waldron--------	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood--	110	156	Eastern cottonwood, pin oak, green ash, silver maple.
						Pin oak-------------	80	62	
50C, 50C2, 50D2- Bunceton	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	Eastern white pine, green ash, black walnut.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
51C2------------ Knox	4A	Slight	Slight	Slight	Slight	White oak-----------	69	51	Eastern white pine, green ash, black walnut.
						Northern red oak----	78	60	
						Black oak-----------	74	56	
52C2------------ Ladoga	4A	Slight	Slight	Slight	Slight	White oak-----------	75	57	Eastern white pine, white oak, northern red oak, black walnut.
						Northern red oak----	79	61	
						Black oak-----------	74	56	
56-------------- Leta	7C	Slight	Moderate	Severe	Severe	Eastern cottonwood--	90	103	Pecan, eastern cottonwood, silver maple, green ash.
						Black willow--------	---	---	
60F------------- Lindley	3R	Moderate	Moderate	Slight	Slight	White oak-----------	56	39	Northern red oak, black oak, white oak, eastern white pine.
						Northern red oak----	61	44	
						Black oak-----------	63	46	
64B------------- McGirk	3W	Slight	Severe	Moderate	Moderate	White oak-----------	55	38	Pin oak, green ash, pecan, eastern cottonwood.
66C, 66C2, 66D2- Menfro	4A	Slight	Slight	Slight	Slight	Northern red oak----	81	63	White oak, black oak, northern red oak, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	52	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
66F------------- Menfro	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	81	63	White oak, sugar maple, shortleaf pine, green ash, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	52	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
67C2------------ Menfro	4A	Slight	Slight	Slight	Slight	Northern red oak----	81	63	White oak, black oak, northern red oak, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	52	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
70C: Moko-----------	2X	Slight	Moderate	Moderate	Severe	Eastern redcedar----	30	32	Eastern redcedar.
Rock outcrop.									
70F: Moko-----------	2R	Severe	Severe	Moderate	Severe	Eastern redcedar----	30	32	Eastern redcedar.
Rock outcrop.									

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
72-------------- Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	70	52	White oak, pin oak, green ash, eastern cottonwood, silver maple.
76-------------- Motark	9A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Green ash----------- Black walnut--------	100 --- ---	128 --- ---	Eastern cottonwood, black walnut, northern red oak, white oak, green ash, pecan.
80B, 80B2, 80C2- Pershing	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	Eastern white pine, white oak, black oak, pin oak.
82-------------- Sarpy	8S	Slight	Slight	Severe	Slight	Eastern cottonwood--	95	116	Eastern cottonwood, American sycamore, silver maple.
88-------------- Sturkie	4W	Slight	Moderate	Slight	Slight	Northern red oak---- White oak----------- American sycamore--- Eastern cottonwood--	80 70 80 100	62 52 62 128	Northern red oak, white oak, American sycamore, eastern cottonwood.
92-------------- Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood-- Pin oak-------------	110 80	156 62	Eastern cottonwood, pin oak, green ash, silver maple.
93B, 93B2, 93C2, 93D2----------- Cotton	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	White oak, pin oak, black oak.
94B, 94B2, 94C2, 94D2----------- Weller	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	Eastern white pine, white oak, black oak.
95C, 95C2, 95D2- Wrengart	3A	Slight	Slight	Slight	Slight	Black oak----------- White oak----------- Northern red oak---- Shagbark hickory----	63 53 --- ---	46 36 --- ---	Black oak, white oak, shortleaf pine, northern red oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
95E------------- Wrengart	3R	Moderate	Moderate	Moderate	Slight	Black oak----------- White oak----------- Northern red oak---- Shagbark hickory----	63 53 --- ---	46 36 --- ---	Black oak, white oak, shortleaf pine, northern red oak.
96C, 96C2, 96D2- Winfield	3A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Black oak-----------	65 60 65	48 43 48	Eastern white pine, green ash, northern red oak, black oak.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10----------------- Ackmore	---	Silky dogwood, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
11B, 11B2, 11C2--- Arisburg	Fragrant sumac, redosier dogwood.	American plum-----	Eastern redcedar, Amur maple.	Austrian pine, hackberry, eastern white pine, Norway spruce, green ash, silver maple.	Eastern cottonwood.
13B---------------- Jemerson	---	American cranberrybush, Amur privet, silky dogwood.	Washington hawthorn, blue spruce, white fir.	Austrian pine, eastern white pine, Norway spruce.	Pin oak.
15D2, 15F--------- Newcomer	Fragrant sumac, lilac.	American plum, Amur maple, gray dogwood, eastern redcedar, Washington hawthorn.	Austrian pine, hackberry, Virginia pine, honeylocust.	---	---
17C2, 17D2, 17E2-- Bluelick	---	Amur privet, American cranberrybush, silky dogwood.	Blue spruce, northern whitecedar, white fir, Washington hawthorn.	Austrian pine, eastern white pine, Norway spruce.	Pin oak.
20----------------- Bremer	---	Silky dogwood, Amur privet, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
25A---------------- Chauncey	---	Silky dogwood, Amur privet, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
27B---------------- Clafork	Fragrant sumac, lilac.	American plum, Amur maple, gray dogwood, Washington hawthorn, eastern redcedar.	Eastern redcedar, hackberry, Russian-olive.	Eastern white pine, Norway spruce, green ash, honeylocust, pin oak.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
27B2, 27C2. Clafork	Fragrant sumac, lilac.	American plum, Amur maple, gray dogwood, Washington hawthorn, eastern redcedar.	Hackberry, shortleaf pine, honeylocust, Virginia pine.	---	---
28A. Dameron	---	Lilac, Amur maple, blackhaw, gray dogwood.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.
29. Darwin	---	Amur privet, silky dogwood, American cranberrybush.	Austrian pine, northern whitecedar, blue spruce, Washington hawthorn, white fir.	Eastern white pine, Norway spruce.	Pin oak.
30. Dockery	Fragrant sumac	American plum, silky dogwood, blackhaw.	Washington hawthorn, nannyberry viburnum, white fir.	Green ash, eastern white pine, Norway spruce.	Pin oak, eastern cottonwood.
32A, 32B2. Crestmeade	Lilac	Amur maple, Manchurian crabapple, deciduous holly.	Austrian pine, hackberry, eastern redcedar, green ash, Russian-olive, Norway spruce.	Honeylocust	---
33. Eudora	---	Siberian peashrub	Green ash, Osage-orange, eastern redcedar, northern whitecedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	Eastern cottonwood.
34D. Eldon	Amur honeysuckle, lilac, fragrant sumac.	Gray dogwood	Green ash, hackberry, honeylocust, bur oak, Russian-olive, Austrian pine, eastern redcedar.	Siberian elm	---
35A, 35B. Freeburg	Fragrant sumac	American plum, blackhaw, gray dogwood, silky dogwood.	Washington hawthorn, eastern redcedar.	Green ash, eastern white pine, pin oak, Norway spruce, sweetgum.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
38B2: Glensted	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Northern red oak, honeylocust, Norway spruce, golden willow, silver maple, green ash.	Eastern cottonwood.
40C, 40D: Goss	Lilac, fragrant sumac.	Gray dogwood, American plum.	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
40F: Goss	Fragrant sumac, lilac.	Gray dogwood, American plum.	Eastern redcedar, hackberry, Russian-olive, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
41: Grable	---	Siberian peashrub	Nannyberry viburnum, Washington hawthorn, white spruce, northern whitecedar, eastern redcedar, green ash.	Black willow, golden willow.	Eastern cottonwood.
46: Haynie	---	Nannyberry viburnum, Siberian peashrub.	Washington hawthorn, eastern redcedar, northern whitecedar, white spruce, green ash.	Black willow	Eastern cottonwood.
47:					
Haynie	---	Nannyberry viburnum, Siberian peashrub.	Washington hawthorn, eastern redcedar, northern whitecedar, white spruce, green ash.	Black willow	Eastern cottonwood.
Waldron	---	American plum, blackhaw, nannyberry viburnum, Washington hawthorn.	Eastern redcedar, green ash, northern whitecedar, white spruce.	Bur oak	---
48B: Higginsville	---	Lilac, Amur maple, silky dogwood, American plum.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
50C, 50C2, 50D2--- Bunceton	Fragrant sumac, redosier dogwood.	Silky dogwood, arrowwood, American plum.	Washington hawthorn.	Green ash, Douglas-fir, pin oak, sweetgum, white fir.	Eastern white pine.
51C2-------------- Knox	---	Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
52C2-------------- Ladoga	---	Lilac, Amur maple, silky dogwood.	Eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
53---------------- Buckney	Lilac-------------	Amur maple--------	Bur oak, green ash, eastern redcedar, Russian-olive, honeylocust.	Ponderosa pine, eastern white pine, hackberry.	---
54A--------------- Leslie	Buttonbush--------	American cranberrybush, Washington hawthorn, Amur privet, arrowwood.	Eastern redcedar, hackberry, northern whitecedar, green ash.	Baldcypress, pin oak.	---
54B, 54B2--------- Leslie	Lilac-------------	Manchurian crabapple, American cranberrybush, arrowwood, Washington hawthorn.	Hackberry, Austrian pine, eastern redcedar, green ash.	Honeylocust, pin oak, eastern white pine.	---
56---------------- Leta	---	American plum, blackhaw, Washington hawthorn, nannyberry viburnum.	Eastern redcedar, green ash, northern whitecedar, sweetgum, white spruce.	Bur oak-----------	---
60F--------------- Lindley	Redosier dogwood	Silky dogwood, arrowwood, American plum.	Washington hawthorn.	Green ash, white fir, northern red oak, Douglas-fir, pin oak.	Eastern white pine.
64B--------------- McGirk	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
66C, 66C2, 66D2, 66F, 67C2-------- Menfro	Fragrant sumac----	Gray dogwood, American plum, arrowwood.	Eastern redcedar, eastern redbud, Washington hawthorn.	Green ash, northern red oak, white fir, yellow-poplar.	Eastern white pine.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
70C, 70F:					
Moko.					
Rock outcrop.					
72 Moniteau	Buttonbush	Possumhaw	Hackberry, eastern redcedar, northern whitecedar, nannyberry viburnum.	Pin oak, baldcypress.	Eastern cottonwood.
75 Shannondale	Silky dogwood	American plum, arrowwood.	Eastern redcedar	Austrian pine, pin oak, green ash, red pine, hackberry, Austrian pine, honeylocust.	Eastern cottonwood, eastern white pine.
76 Motark	Redosier dogwood, fragrant sumac.	American plum, blackhaw.	White fir, nannyberry viburnum, Washington hawthorn.	Green ash, eastern white pine, Norway spruce.	Pin oak, eastern cottonwood.
80B, 80B2, 80C2 Pershing	---	Eastern redcedar, American cranberrybush, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
82 Sarpy	---	Siberian peashrub	Northern whitecedar, white spruce, nannyberry viburnum, eastern redcedar, Washington hawthorn, green ash.	Black willow	Eastern cottonwood, European alder.
86, 87A Speed	---	Lilac, American cranberrybush, silky dogwood.	Eastern redcedar, Washington hawthorn, northern whitecedar, white fir.	Hackberry, green ash, honeylocust, Norway spruce.	Eastern cottonwood, eastern white pine, pin oak.
88. Sturkie					
90B, 90C2 Wakenda	---	American cranberrybush, Amur privet, silky dogwood.	Blue spruce, Washington hawthorn, northern whitecedar, white fir.	Austrian pine, eastern white pine, Norway spruce.	Pin oak.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
92. Waldron	---	American plum, blackhaw, nannyberry viburnum, Washington hawthorn.	Eastern redcedar, green ash, northern whitecedar, white spruce.	Bur oak	---
93B, 93B2, 93C2, 93D2. Cotton	Lilac	Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---
94B, 94B2, 94C2, 94D2. Weller	---	American cranberrybush, arrowwood, Washington hawthorn, Amur privet, eastern redcedar.	Green ash, Austrian pine.	Eastern white pine, pin oak.	---
95C, 95C2, 95D2, 95E. Wrengart	Redosier dogwood, fragrant sumac.	American plum, silky dogwood, arrowwood.	Washington hawthorn, eastern redcedar.	Green ash, northern red oak, white fir.	Eastern white pine.
96C, 96C2, 96D2. Winfield	Redosier dogwood, fragrant sumac.	Silky dogwood, American plum, arrowwood.	Washington hawthorn.	Green ash, Douglas-fir, sweetgum, northern red oak, white fir.	Eastern white pine.
99. Zook	---	Silky dogwood, American cranberrybush, Amur privet.	Norway spruce, northern whitecedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
100. Pits					

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
10 Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
11B, 11B2 Arisburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
11C2 Arisburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
13B Jemerson	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
15D2 Newcomer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
15F Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
17C2 Bluelick	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
17D2 Bluelick	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
17E2 Bluelick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
20 Bremer	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
25A Chauncey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
27B, 27B2 Clafork	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
27C2 Clafork	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
28A Dameron	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
29 Darwin	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
30 Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: flooding.
32A, 32B2 Crestmeade	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
33 Eudora	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
34D Eldon	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
35A Freeburg	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
35B Freeburg	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
38B2 Glensted	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
40C Goss	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Moderate: droughty.
40D Goss	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
40F Goss	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, droughty, slope.
41 Grable	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
46 Haynie	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
47:					
Haynie	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Waldron	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
48B Higginsville	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
50C, 50C2 Bunceton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
50D2 Bunceton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
51C2 Knox	Slight	Slight	Severe: slope.	Slight	Slight.
52C2 Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
53 Buckney	Severe: flooding.	Slight	Moderate: flooding.	Slight	Severe: droughty.
54A Leslie	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Severe: wetness.
54B, 54B2 Leslie	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
56 Leta	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
60F Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
64B McGirk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
66C, 66C2 Menfro	Slight	Slight	Severe: slope.	Slight	Slight.
66D2 Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
66F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
67C2 Menfro	Slight	Slight	Severe: slope.	Slight	Slight.
70C:					
Moko	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, small stones.	Severe: large stones.	Severe: large stones, droughty.
Rock outcrop.					
70F:					
Moko	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, small stones.	Severe: large stones, slope.	Severe: large stones, droughty, slope.
Rock outcrop.					
72 Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
75-------------------- Shannondale	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
76-------------------- Motark	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
80B, 80B2------------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
80C2------------------ Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
82-------------------- Sarpy	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, flooding.
86-------------------- Speed	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
87A------------------- Speed	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
88-------------------- Sturkie	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
90B------------------- Wakenda	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
90C2------------------ Wakenda	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
92-------------------- Waldron	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
93B, 93B2------------- Cotton	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
93C2------------------ Cotton	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness.
93D2------------------ Cotton	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
94B, 94B2------------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
94C2 Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
94D2 Weller	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
95C, 95C2 Wrengart	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
95D2 Wrengart	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
95E Wrengart	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
96C, 96C2 Winfield	Slight	Slight	Severe: slope.	Slight	Slight.
96D2 Winfield	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
99 Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
100. Pits					

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10----------------- Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
11B, 11B2, 11C2---- Arisburg	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
13B---------------- Jemerson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
15D2--------------- Newcomer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
15F---------------- Newcomer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
17C2, 17D2--------- Bluelick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
17E2--------------- Bluelick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
20----------------- Bremer	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
25A---------------- Chauncey	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
27B, 27B2, 27C2---- Clafork	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
28A---------------- Dameron	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
29----------------- Darwin	Poor	Poor	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
30----------------- Dockery	Poor	Fair	Fair	Good	Good	Good	Fair	Fair	Good	Fair.
32A, 32B2---------- Crestmeade	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
33----------------- Eudora	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
34D---------------- Eldon	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
35A, 35B----------- Freeburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
38B2--------------- Glensted	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
40C, 40D----------- Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
40F---------------- Goss	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
41----------------- Grable	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
46----------------- Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
47:										
Haynie------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Waldron-----------	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
48B---------------- Higginsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
50C, 50C2, 50D2---- Bunceton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
51C2--------------- Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
52C2--------------- Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
53----------------- Buckney	Fair	Good	Good	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.
54A, 54B, 54B2----- Leslie	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
56----------------- Leta	Fair	Fair	Poor	Good	Good	Poor	Fair	Fair	Fair	Poor.
60F---------------- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
64B---------------- McGirk	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
66C, 66C2, 66D2---- Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
66F---------------- Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
67C2--------------- Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
70C, 70F:										
Moko--------------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.										
72----------------- Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
75-----------------Shannondale	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
76-----------------Motark	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair.
80B, 80B2----------Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
80C2---------------Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
82-----------------Sarpy	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
86, 87A------------Speed	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
88-----------------Sturkie	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
90B----------------Wakenda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
90C2---------------Wakenda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
92-----------------Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
93B, 93B2, 93C2, 93D2--------------Cotton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
94B, 94B2----------Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
94C2, 94D2---------Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
95C, 95C2, 95D2, 95E---------------Wrengart	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
96C, 96C2, 96D2----Winfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
99-----------------Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
100. Pits										

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10----------------- Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
11B, 11B2, 11C2--- Arisburg	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
13B---------------- Jemerson	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
15D2--------------- Newcomer	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope, depth to rock.
15F---------------- Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
17C2--------------- Bluelick	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
17D2--------------- Bluelick	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
17E2--------------- Bluelick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
20----------------- Bremer	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
25A---------------- Chauncey	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
27B, 27B2, 27C2--- Clafork	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
28A---------------- Dameron	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
29----------------- Darwin	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
30---------------- Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
32A, 32B2--------- Crestmeade	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
33---------------- Eudora	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
34D--------------- Eldon	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: small stones, large stones, slope.
35A--------------- Freeburg	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
35B--------------- Freeburg	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
38B2-------------- Glensted	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
40C--------------- Goss	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, frost action.	Moderate: droughty.
40D--------------- Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: droughty, slope.
40F--------------- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, droughty, slope.
41---------------- Grable	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
46---------------- Haynie	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
47:						
Haynie-----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47:						
Waldron----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
48B--------------- Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
50C, 50C2--------- Bunceton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
50D2-------------- Bunceton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
51C2-------------- Knox	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
52C2-------------- Ladoga	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
53---------------- Buckney	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
54A--------------- Leslie	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
54B, 54B2--------- Leslie	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
56---------------- Leta	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
60F--------------- Lindley	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
64B--------------- McGirk	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
66C, 66C2--------- Menfro	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
66D2-------------- Menfro	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
66F--------------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
67C2: Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
70C:						
Moko	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, droughty.
Rock outcrop.						
70F:						
Moko	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, droughty, slope.
Rock outcrop.						
72: Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
75: Shannondale	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Slight.
76: Motark	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
80B, 80B2, 80C2: Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
82: Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
86: Speed	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
87A: Speed	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
88: Sturkie	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
90B: Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
90C2: Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
92----------------- Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
93B, 93B2--------- Cotton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
93C2--------------- Cotton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: wetness.
93D2--------------- Cotton	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
94B, 94B2, 94C2--- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
94D2--------------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: slope.
95C, 95C2--------- Wrengart	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
95D2--------------- Wrengart	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
95E---------------- Wrengart	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
96C, 96C2--------- Winfield	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
96D2--------------- Winfield	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
99----------------- Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
100. Pits						

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10------------------ Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
11B, 11B2----------- Arisburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
11C2---------------- Arisburg	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
13B----------------- Jemerson	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: flooding, wetness.	Fair: too clayey.
15D2---------------- Newcomer	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
15F----------------- Newcomer	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
17C2---------------- Bluelick	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, small stones.
17D2---------------- Bluelick	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, small stones.
17E2---------------- Bluelick	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
20------------------ Bremer	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
25A----------------- Chauncey	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27B, 27B2----------- Clafork	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
27C2---------------- Clafork	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
28A------------------ Dameron	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: small stones.
29------------------- Darwin	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
30------------------- Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
32A, 32B2------------ Crestmeade	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
33------------------- Eudora	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
34D------------------ Eldon	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
35A------------------ Freeburg	Severe: flooding, wetness, percs slowly.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
35B------------------ Freeburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
38B2----------------- Glensted	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
40C------------------ Goss	Moderate: percs slowly, large stones.	Severe: seepage.	Severe: too clayey, large stones.	Slight-----------	Poor: too clayey, small stones.
40D------------------ Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
40F------------------ Goss	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
41------------------- Grable	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: too sandy.
46------------------- Haynie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47:					
Haynie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
48B Higginsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
50C, 50C2 Bunceton	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
50D2 Bunceton	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, thin layer.
51C2 Knox	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
52C2 Ladoga	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
53 Buckney	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
54A Leslie	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
54B, 54B2 Leslie	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
56 Leta	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
60F Lindley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
64B McGirk	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
66C, 66C2 Menfro	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
66D2 Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
66F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
67C2 Menfro	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
70C:					
Moko	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop.					
70F:					
Moko	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Rock outcrop.					
72 Moniteau	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
75 Shannondale	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
76 Motark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
80B, 80B2 Pershing	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
80C2 Pershing	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
82 Sarpy	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
86 Speed	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
87A: Speed	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
88: Sturkie	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
90B: Wakenda	Moderate: wetness.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Moderate: wetness.	Fair: too clayey.
90C2: Wakenda	Moderate: wetness.	Severe: slope.	Moderate: too clayey.	Moderate: wetness.	Fair: too clayey.
92: Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
93B, 93B2: Cotton	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
93C2: Cotton	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
93D2: Cotton	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Poor: small stones.
94B, 94B2: Weller	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
94C2: Weller	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
94D2: Weller	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
95C, 95C2: Wrengart	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
95D2: Wrengart	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
95E: Wrengart	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
96C, 96C2: Winfield	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
96D2----------------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
99------------------- Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
100. Pits					

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10-------------------- Ackmore	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
11B, 11B2, 11C2------- Arisburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
13B------------------- Jemerson	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
15D2------------------ Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, slope.
15F------------------- Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
17C2, 17D2------------ Bluelick	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
17E2------------------ Bluelick	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
20-------------------- Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
25A------------------- Chauncey	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
27B, 27B2, 27C2------- Clafork	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
28A------------------- Dameron	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
29-------------------- Darwin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
30-------------------- Dockery	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
32A, 32B2------------- Crestmeade	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
33-------------------- Eudora	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
34D-------------------- Eldon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
35A, 35B-------------- Freeburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
38B2------------------- Glensted	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
40C, 40D-------------- Goss	Fair: shrink-swell, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
40F-------------------- Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
41--------------------- Grable	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
46--------------------- Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
47:				
Haynie----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waldron---------------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
48B-------------------- Higginsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
50C, 50C2, 50D2-------- Bunceton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
51C2------------------- Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
52C2------------------- Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
53--------------------- Buckney	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
54A-------------------- Leslie	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
54B, 54B2-------------- Leslie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
56--------------------- Leta	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
60F: Lindley	Fair: shrink-swell, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
64B: McGirk	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
66C, 66C2: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
66D2: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
66F: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
67C2: Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
70C:				
Moko	Poor: depth to rock, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, large stones.
Rock outcrop.				
70F:				
Moko	Poor: depth to rock, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, large stones, slope.
Rock outcrop.				
72: Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
75: Shannondale	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
76: Motark	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
80B, 80B2, 80C2: Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
82: Sarpy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
86, 87A: Speed	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
88 Sturkie	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
90B, 90C2 Wakenda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
92 Waldron	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
93B, 93B2, 93C2, 93D2 Cotton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
94B, 94B2, 94C2, 94D2 Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
95C, 95C2, 95D2 Wrengart	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
95E Wrengart	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
96C, 96C2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
96D2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
99 Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
100. Pits				

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
10: Ackmore	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
11B, 11B2, 11C2: Arisburg	Moderate: slope.	Moderate: hard to pack, wetness.	Frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
13B: Jemerson	Moderate: seepage, slope.	Moderate: thin layer, piping, wetness.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
15D2, 15F: Newcomer	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
17C2: Bluelick	Moderate: slope.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
17D2, 17E2: Bluelick	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
20: Bremer	Slight	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
25A: Chauncey	Slight	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
27B, 27B2, 27C2: Clafork	Moderate: slope.	Moderate: hard to pack, wetness.	Slope	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
28A: Dameron	Moderate: seepage.	Slight	Deep to water	Flooding	Favorable	Favorable.
29: Darwin	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
30: Dockery	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
32A, 32B2: Crestmeade	Slight	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
33: Eudora	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
34D: Eldon	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
35A: Freeburg	Slight	Moderate: wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
35B-------------- Freeburg	Slight---------	Moderate: wetness.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
38B2-------------- Glensted	Moderate: seepage, slope.	Severe: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness--------	Wetness, percs slowly.
40C--------------- Goss	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Large stones, erodes easily.	Large stones, erodes easily.
40D--------------- Goss	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
40F--------------- Goss	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
41---------------- Grable	Severe: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
46---------------- Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
47:						
Haynie-----------	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
Waldron----------	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
48B--------------- Higginsville	Moderate: seepage, slope.	Moderate: wetness.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
50C, 50C2--------- Bunceton	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
50D2-------------- Bunceton	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
51C2-------------- Knox	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
52C2-------------- Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.
53---------------- Buckney	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty-------	Too sandy, soil blowing.	Droughty.
54A--------------- Leslie	Slight---------	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
54B--------------- Leslie	Slight---------	Moderate: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
54B2-------------- Leslie	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
56---------------- Leta	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness---------	Wetness, percs slowly.
60F--------------- Lindley	Severe: slope.	Moderate: piping, wetness.	Slope----------	Wetness, slope.	Slope, wetness.	Slope.
64B--------------- McGirk	Moderate: slope.	Severe: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
66C, 66C2--------- Menfro	Moderate: seepage, slope.	Slight---------	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
66D2, 66F--------- Menfro	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
67C2-------------- Menfro	Moderate: seepage, slope.	Slight---------	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
70C:						
Moko-------------	Severe: depth to rock.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Rock outcrop.						
70F:						
Moko-------------	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
72---------------- Moniteau	Slight---------	Severe: wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
75---------------- Shannondale	Severe: seepage.	Moderate: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.
76---------------- Motark	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Favorable.
80B, 80B2, 80C2--- Pershing	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
82---------------- Sarpy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
86: Speed	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
87A: Speed	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
88: Sturkie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
90B, 90C2: Wakenda	Moderate: seepage, slope.	Slight	Deep to water	Slope	Favorable	Favorable.
92: Waldron	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
93B, 93B2, 93C2: Cotton	Moderate: slope.	Severe: piping.	Percs slowly, large stones, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
93D2: Cotton	Severe: slope.	Severe: piping.	Percs slowly, large stones, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
94B, 94B2, 94C2: Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
94D2: Weller	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
95C, 95C2: Wrengart	Moderate: seepage, slope.	Moderate: piping, wetness.	Slope	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
95D2, 95E: Wrengart	Severe: slope.	Moderate: piping, wetness.	Slope	Slope, wetness, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
96C, 96C2: Winfield	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
96D2: Winfield	Severe: slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
99: Zook	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
100. Pits						

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
10------------ Ackmore	0-9	Silt loam-----	CL, ML	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-50	8-20
	9-24	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-50	8-20
	24-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	95-100	85-100	35-60	15-30
11B----------- Arisburg	0-13	Silt loam-----	CL	A-6	0	0	100	100	90-100	70-90	25-40	10-20
	13-36	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	85-95	35-50	15-25
	36-56	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	0	100	100	95-100	85-95	35-60	20-35
	56-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	35-50	20-35
11B2, 11C2---- Arisburg	0-8	Silt loam-----	CL	A-6	0	0	100	100	90-100	70-90	25-40	10-20
	8-26	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	85-95	35-50	15-25
	26-50	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	0	100	100	95-100	85-95	35-60	20-35
	50-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	35-50	20-30
13B----------- Jemerson	0-9	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	24-30	6-11
	9-55	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	90-100	70-95	25-40	11-20
	55-60	Silt loam, loam.	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	85-100	60-90	25-35	7-15
15D2---------- Newcomer	0-8	Silt loam-----	CL, CL-ML	A-4	0	0	100	100	90-100	70-90	25-30	5-10
	8-28	Silt loam, loam, clay loam.	CL, SC	A-4, A-6	0	0	85-100	90-100	85-100	60-90	22-40	9-22
	28-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
15F----------- Newcomer	0-14	Silt loam-----	CL, CL-ML	A-4	0	0	100	100	90-100	70-90	25-30	5-10
	14-24	Silt loam, loam, clay loam.	CL, SC	A-4, A-6	0	0	85-100	90-100	85-100	60-90	22-40	9-22
	24-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
17C2, 17D2---- Bluelick	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	5-15
	7-33	Silty clay loam, silty clay.	CL	A-6, A-7	0	0	85-100	85-100	75-100	60-90	35-50	11-25
	33-60	Extremely gravelly silty clay, very gravelly clay, very gravelly silty clay.	GC	A-2-7, A-7	0	0-10	30-50	25-50	25-45	20-40	50-70	25-45
17E2---------- Bluelick	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	5-15
	7-26	Silty clay loam, silty clay.	CL	A-6, A-7	0	0	85-100	85-100	75-100	60-90	35-50	11-25
	26-60	Extremely gravelly silty clay, very gravelly clay, very gravelly silty clay.	GC	A-2-7, A-7	0	0-10	30-50	25-50	25-45	20-40	50-70	25-45
20------------ Bremer	0-14	Silt loam-----	CL, ML	A-6, A-7	0	0	100	100	100	95-100	35-45	10-20
	14-48	Silty clay loam, silty clay.	CH, MH	A-7	0	0	100	100	100	95-100	50-65	20-35
	48-60	Silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	95-100	40-60	25-40
25A----------- Chauncey	0-12	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	90-100	90-100	25-35	7-15
	12-26	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	90-100	20-30	5-10
	26-47	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-35
	47-60	Silty clay loam, clay loam, silt loam.	ML, CL	A-6, A-7	0	0-5	95-100	95-100	90-100	80-95	35-45	10-20
27B----------- Clafork	0-11	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	11-39	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	85-95	48-66	27-40
	39-59	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	90-100	90-100	80-90	65-85	25-40	7-22
	59-72	Very gravelly silt loam, extremely gravelly silty clay loam.	GC	A-2, A-4, A-6	0-5	0-10	25-50	20-50	20-50	15-45	25-40	7-20
	72-76	Very gravelly silty clay, extremely gravelly silty clay loam.	GC	A-2, A-6, A-7	0-5	0-15	25-50	20-50	20-50	15-45	35-50	13-23

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
27B2, 27C2----- Clafork	0-8	Silt loam-----	CL	A-6	0	0	100	100	90-100	80-90	35-40	11-16
	8-24	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	85-95	48-66	27-40
	24-49	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	90-100	90-100	80-90	65-85	25-40	7-22
	49-60	Very gravelly silt loam, extremely gravelly silty clay loam.	GC	A-2, A-4, A-6	0-5	0-10	25-50	20-50	20-50	15-45	25-40	7-20
28A----------- Dameron	0-8	Silt loam-----	CL	A-6	0	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	8-28	Silt loam, silty clay loam.	CL	A-6	0	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	28-60	Very gravelly silty clay loam, gravelly silty clay loam, very gravelly clay loam.	GC, SC, CL	A-2-6, A-6	0	5-15	35-75	25-70	25-70	20-65	30-40	15-25
29------------ Darwin	0-10	Silty clay----	CH, CL	A-7	0	0	100	100	100	90-100	45-85	25-55
	10-45	Silty clay, clay.	CH, CL	A-7	0	0	100	100	100	85-100	45-85	25-55
	45-60	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0	0	100	100	95-100	90-100	35-70	20-45
30------------ Dockery	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	7-60	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	100	100	90-100	85-95	25-40	8-20
32A----------- Crestmeade	0-11	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	11-18	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	70-95	25-40	12-25
	18-34	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	70-95	55-75	33-49
	34-52	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	85-95	42-58	22-35
	52-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	90-100	90-100	80-95	70-90	36-50	17-30
32B2---------- Crestmeade	0-7	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	7-24	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	70-95	55-75	33-49
	24-44	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	85-95	42-58	22-35
	44-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	90-100	90-100	80-95	70-90	36-50	17-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
33------------ Eudora	0-17	Loam----------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	85-100	60-100	20-30	2-11
	17-60	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	0	100	100	95-100	65-100	<25	NP-10
34D----------- Eldon	0-6	Gravelly silt loam.	ML, CL-ML, CL	A-4	0-5	0-25	70-95	55-70	60-85	55-80	20-30	2-8
	6-18	Very gravelly silty clay loam, gravelly silty clay loam, gravelly silt loam.	GC, CL	A-2-7, A-6, A-7	0-5	5-15	40-60	35-55	20-55	20-55	30-45	11-20
	18-28	Extremely gravelly silty clay loam, extremely gravelly silty clay.	GC, GP-GC	A-2-7	0-5	0-10	20-35	15-25	10-25	10-25	40-60	20-30
	28-60	Silty clay, clay, gravelly clay.	CL, CH, ML, MH	A-7	0	0-15	80-100	65-100	65-100	65-100	45-95	25-50
35A, 35B------ Freeburg	0-14	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	90-100	15-35	5-15
	14-50	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	85-100	85-100	30-45	15-25
	50-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	85-100	85-100	30-45	15-25
38B2---------- Glensted	0-8	Silt loam-----	CL	A-6	0	0	100	100	95-100	80-95	30-40	12-22
	8-14	Silty clay----	CH	A-7	0	0	100	100	95-100	90-95	55-65	30-40
	14-33	Silty clay, clay.	CH	A-7	0	0	95-100	80-95	75-95	70-85	55-75	30-50
	33-44	Silty clay loam, silty clay.	CL, CH	A-7	0	0	95-100	80-95	75-95	65-85	45-60	25-35
	44-60	Silty clay loam, clay loam.	CL	A-7	0	0	95-100	80-95	75-90	60-80	40-50	20-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
40C, 40D------ Goss	0-6	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	6-18	Very gravelly silty clay loam, very gravelly silt loam, gravelly silty clay loam.	GM, GC, GM-GC	A-2	0-5	5-40	40-60	35-55	30-50	25-35	20-30	2-10
	18-60	Gravelly silty clay, extremely gravelly silty clay, very gravelly silty clay.	GC, SC	A-7, A-2-7	0-5	5-45	45-70	35-55	20-50	20-45	50-70	30-40
40F----------- Goss	0-4	Gravelly silt loam.	ML, CL, CL-ML	A-4	5-10	15-50	55-70	55-70	55-70	65-85	20-30	2-8
	4-29	Very gravelly silt loam, very gravelly silty clay loam.	GC	A-2-6	5-10	15-50	40-60	35-55	30-50	25-35	30-40	11-18
	29-44	Very gravelly clay, very gravelly silty clay.	GC	A-7, A-2-7	5-10	10-50	45-70	35-55	20-50	20-45	50-70	30-40
	44-60	Silty clay, clay, gravelly clay.	CH	A-7	0	0-10	70-100	70-100	70-95	70-95	60-80	30-45
41------------ Grable	0-6	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-75	25-35	5-15
	6-23	Very fine sandy loam, silt loam.	CL, CL-ML	A-4	0	0	100	100	80-95	80-95	20-30	5-10
	23-39	Loamy fine sand, fine sand.	SM, SP-SM, SC-SM	A-2, A-3	0	0	100	100	65-80	5-35	<20	NP-5
	39-60	Stratified loamy fine sand to silt loam.	CL, ML, SM, SC	A-4, A-2-4	0	0	100	100	70-90	25-70	20-30	NP-10
46------------ Haynie	0-9	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	50-90	25-40	5-15
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	85-100	50-90	25-35	5-15
47:												
Haynie-------	0-9	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	25-40	5-15
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	85-100	50-90	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
47:												
Waldron------	0-9	Silty clay loam.	CL	A-7	0	0	100	100	95-100	85-95	30-45	15-25
	9-48	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-65	20-45
	48-60	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	50-65	25-35	5-15
48B----------- Higginsville	0-20	Silt loam-----	CL	A-6	0	0	100	100	95-100	95-100	30-40	10-15
	20-27	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	27-47	Silty clay loam.	CL	A-7	0	0	100	100	95-100	90-100	40-50	15-25
	47-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	90-100	35-45	10-20
50C----------- Bunceton	0-8	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	8-11	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	75-95	30-44	11-22
	11-31	Silty clay loam, silt loam, gravelly silt loam.	CL, GC, SC	A-2, A-4, A-6, A-7	0-5	0-10	25-90	20-85	20-85	15-75	25-44	7-21
	31-48	Gravelly silt loam, gravelly silty clay loam, very gravelly silt loam.	CL, GC, SC	A-2, A-6, A-7	0-10	0-20	15-70	15-65	15-65	10-60	30-45	11-20
	48-60	Silty clay, clay, gravelly clay.	CL, CH	A-7	0	0-5	65-95	65-90	60-90	55-85	45-60	20-30
50C2, 50D2---- Bunceton	0-8	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	8-25	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	75-95	30-44	11-22
	25-45	Silty clay loam, silt loam, gravelly silt loam.	CL, GC, SC	A-2, A-4, A-6, A-7	0-5	0-10	25-90	20-85	20-85	15-75	25-44	7-21
	45-54	Gravelly silt loam, gravelly silty clay loam, very gravelly silt loam.	CL, GC, SC	A-2, A-6, A-7	0-10	0-20	15-70	15-65	15-65	10-60	30-45	11-20
	54-60	Silty clay, clay, gravelly clay.	CL, CH	A-7	0	0-5	65-95	65-90	60-90	55-85	45-60	20-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
51C2---------- Knox	0-8	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0	100	100	95-100	90-100	20-35	2-15
	8-48	Silty clay loam, silt loam.	CL	A-7	0	0	100	100	95-100	95-100	40-50	20-30
	48-60	Silt loam-----	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	10-25
52C2---------- Ladoga	0-8	Silt loam-----	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	8-36	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	36-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
53------------ Buckney	0-10	Fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	<20	NP-7
	10-15	Fine sandy loam, loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4	0	0	100	100	70-95	40-60	<20	NP-7
	15-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-2-4, A-4	0	0	100	100	65-90	10-40	---	NP
54A----------- Leslie	0-9	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	9-14	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	14-22	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25
	22-36	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	85-95	50-60	25-35
	36-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25
54B----------- Leslie	0-11	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	11-16	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	16-20	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25
	20-48	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	85-95	50-60	25-35
	48-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
54B2----------- Leslie	0-6	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	6-10	Silt loam-----	CL-ML, CL, ML	A-4	0	0	100	100	90-100	80-90	25-35	5-10
	10-39	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25
	39-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	85-95	35-50	10-25
56------------- Leta	0-12	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	15-25
	12-26	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	0	100	100	95-100	90-100	35-65	20-40
	26-60	Stratified silt loam to sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	80-100	51-95	20-35	5-15
60F------------ Lindley	0-23	Silt loam-----	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	23-43	Clay loam, loam.	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	10-20
	43-60	Loam, clay loam.	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
64B------------ McGirk	0-17	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-40	5-15
	17-22	Silty clay loam.	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	15-30
	22-59	Silty clay, silty clay loam.	CH, MH	A-7	0	0	100	100	95-100	90-100	50-75	25-40
	59-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	85-100	35-50	11-25
66C------------ Menfro	0-8	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	8-15	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	15-42	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	42-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
66C2, 66D2---- Menfro	0-7	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	7-39	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	39-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
66F------------ Menfro	0-13	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	13-40	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	40-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
67C2----------- Menfro	0-7	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	7-39	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	39-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
70C:												
Moko----------	0-2	Very flaggy silty clay loam.	CL, GC, SC	A-6, A-7	0-15	40-65	65-90	60-85	55-85	45-80	35-45	15-20
	2-11	Very flaggy silt loam, very flaggy silty clay loam.	CL, GC, SC	A-6, A-7	0-15	40-80	65-90	60-85	55-80	40-80	25-45	10-20
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
70F:												
Moko----------	0-3	Very flaggy loam.	CL, GC, SC	A-6	0-15	40-65	65-90	60-85	55-75	40-75	25-35	10-15
	3-9	Very flaggy silt loam, very flaggy silty clay loam.	CL, GC, SC	A-6, A-7	0-15	40-80	65-90	60-85	55-80	40-80	25-45	10-20
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
72------------ Moniteau	0-10	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	10-19	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	19-60	Silty clay loam.	CL	A-6, A-7	0	0	100	100	85-100	80-95	30-45	15-25
75------------ Shannondale	0-19	Silt loam-----	CL	A-6, A-4	0	0	100	100	100	90-100	25-35	7-15
	19-47	Silt loam, silty clay loam.	CL	A-6, A-4	0	0	100	100	100	90-100	25-40	7-20
	47-60	Silty clay loam.	CL	A-7, A-6	0	0	100	100	100	90-100	35-44	15-22
76------------ Motark	0-8	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	70-90	25-40	5-15
	8-60	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	70-90	25-40	5-15
80B----------- Pershing	0-20	Silt loam-----	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	20-27	Silty clay loam.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	27-46	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	46-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35
80B2, 80C2---- Pershing	0-7	Silt loam-----	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	7-14	Silty clay loam.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	15-30
	14-42	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	40-65	20-40
	42-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	35-55	20-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
82------------ Sarpy	0-6	Fine sand-----	SM, SP-SM, SP	A-2-4, A-3	0	0	100	100	60-80	2-15	---	NP
	6-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	0	100	100	60-80	2-35	---	NP
86, 87A------- Speed	0-14	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	90-100	23-32	6-13
	14-27	Silt loam-----	CL, CL-ML	A-4	0	0	100	100	95-100	90-100	23-30	6-10
	27-35	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	100	100	95-100	90-100	28-40	9-18
	35-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	30-40	11-20
88------------ Sturkie	0-10	Silt loam-----	ML, CL-ML, CL	A-4, A-6	0	0	95-100	90-100	75-100	55-95	16-31	3-11
	10-30	Silt loam, loam, silty clay loam.	ML, CL-ML, CL	A-4, A-6	0	0	95-100	90-100	75-100	55-95	16-31	3-11
	30-50	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	95-100	85-100	80-100	65-95	20-38	5-15
	50-60	Silt loam, silty clay loam, loam.	ML, CL-ML, CL, SM	A-4, A-6, A-1, A-2	0	0	90-100	80-100	40-100	10-95	<38	NP-15
90B----------- Wakenda	0-19	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	19-45	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	45-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20
90C2---------- Wakenda	0-10	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	10-43	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	43-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20
92------------ Waldron	0-9	Silty clay loam.	CL	A-7	0	0	100	100	95-100	85-95	30-45	15-25
	9-48	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-65	20-45
	48-60	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	50-65	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
93B----------- Cotton	0-14	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	95-100	90-100	70-90	21-37	5-15
	14-19	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	95-100	90-100	80-95	36-44	15-21
	19-33	Silty clay, silty clay loam.	CL, CH	A-7	0	0	95-100	95-100	95-100	85-95	43-60	21-35
	33-54	Silt loam, silty clay loam, gravelly silty clay loam.	CL-ML, CL, GM-GC, GC	A-2, A-4, A-6	0-5	0-30	30-95	30-95	25-95	20-95	18-36	4-15
	54-60	Very gravelly silt loam, extremely gravelly silt loam, gravelly silt loam.	CL, CH, GC	A-2, A-6, A-7	0-10	0-30	40-90	30-90	30-90	25-80	30-60	11-30
93B2, 93C2, 93D2--------- Cotton	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	95-100	90-100	70-90	21-37	5-15
	7-11	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	95-100	90-100	80-95	36-44	15-21
	11-25	Silty clay, silty clay loam.	CL, CH	A-7	0	0	95-100	95-100	95-100	85-95	43-60	21-35
	25-54	Silt loam, silty clay loam, gravelly silty clay loam.	CL-ML, CL, GM-GC, GC	A-2, A-4, A-6	0-5	0-30	30-95	30-95	25-95	20-95	18-36	4-15
	54-60	Very gravelly silt loam, extremely gravelly silt loam, gravelly silt loam.	CL, CH, GC	A-2, A-6, A-7	0-10	0-30	40-90	30-90	30-90	25-80	30-60	11-30
94B----------- Weller	0-20	Silt loam-----	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	20-50	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	50-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30
94B2, 94C2, 94D2--------- Weller	0-7	Silt loam-----	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	7-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
95C----------- Wrengart	0-10	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	75-90	18-30	4-10
	10-30	Silty clay loam, silt loam.	CL	A-4, A-6	0	0	100	95-100	85-95	75-95	25-40	8-15
	30-50	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	0	100	95-100	85-95	65-95	25-40	8-15
	50-60	Extremely gravelly silty clay loam, very gravelly silty clay loam.	GC	A-2, A-4, A-6	0-5	0-10	25-55	20-50	20-50	15-50	25-40	8-15
95C2, 95D2, 95E---------- Wrengart	0-6	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	75-90	18-30	4-10
	6-26	Silty clay loam, silt loam.	CL	A-4, A-6	0	0	100	95-100	85-95	75-95	25-40	8-15
	26-45	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	0	100	95-100	85-95	65-95	25-40	8-15
	45-60	Extremely gravelly silty clay loam, very gravelly silty clay loam.	GC	A-2, A-4, A-6	0-5	0-10	25-55	20-50	20-50	15-50	25-40	8-15
	60-80	Gravelly silty clay, silty clay, gravelly clay.	CL, CH, GC	A-7	0-5	0-15	55-90	50-90	45-90	40-90	44-70	20-40
96C----------- Winfield	0-14	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	10-20
	14-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-45	15-25
	24-50	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	50-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
96C2, 96D2---- Winfield	0-8	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	10-20
	8-18	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-45	15-25
	18-56	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	56-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
99------------ Zook	0-26	Silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	26-48	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	48-60	Silty clay, silty clay loam, silt loam.	CH, CL, ML	A-6, A-7	0	0	100	100	95-100	95-100	35-85	10-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
100. Pits												

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10---------------- Ackmore	0-9	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-4
	9-24	18-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32			
	24-60	24-38	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.32			
11B--------------- Arisburg	0-13	18-27	1.30-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-3
	13-36	27-35	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.32			
	36-56	35-42	1.35-1.45	0.2-0.6	0.14-0.18	4.5-6.5	High---------	0.37			
	56-60	25-32	1.40-1.50	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.43			
11B2, 11C2-------- Arisburg	0-8	24-27	1.30-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-3
	8-26	27-35	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.32			
	26-50	35-42	1.35-1.45	0.2-0.6	0.14-0.18	4.5-6.5	High---------	0.37			
	50-60	25-32	1.40-1.50	0.2-0.6	0.16-0.18	5.6-7.3	Moderate-----	0.43			
13B--------------- Jemerson	0-9	12-20	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-2
	9-55	18-35	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	55-60	15-27	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.37			
15D2-------------- Newcomer	0-8	15-23	1.30-1.45	0.6-2.0	0.16-0.24	5.6-7.8	Low----------	0.32	4	6	2-4
	8-28	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-----	0.32			
	28-60	---	---	0.2-2.0	---	---	-------------	----			
15F--------------- Newcomer	0-14	15-23	1.30-1.45	0.6-2.0	0.16-0.24	5.6-7.8	Low----------	0.32	4	6	2-4
	14-24	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-----	0.32			
	24-60	---	---	0.2-2.0	---	---	-------------	----			
17C2, 17D2-------- Bluelick	0-7	18-27	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	4	6	1-2
	7-33	35-45	1.20-1.40	0.2-0.6	0.10-0.18	4.5-6.5	Moderate-----	0.37			
	33-60	45-70	1.20-1.40	0.2-0.6	0.02-0.08	4.5-6.5	Moderate-----	0.20			
17E2-------------- Bluelick	0-7	18-27	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	4	6	1-2
	7-26	35-45	1.20-1.40	0.2-0.6	0.10-0.18	4.5-6.5	Moderate-----	0.37			
	26-60	45-70	1.20-1.40	0.2-0.6	0.02-0.08	4.5-6.5	Moderate-----	0.20			
20---------------- Bremer	0-14	22-27	1.25-1.30	0.6-2.0	0.21-0.25	5.6-7.3	Moderate-----	0.32	5	6	3-4
	14-48	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.43			
	48-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.43			
25A--------------- Chauncey	0-12	15-22	1.30-1.50	0.6-2.0	0.22-0.25	4.5-6.5	Low----------	0.37	4	6	2-4
	12-26	15-22	1.25-1.50	0.2-0.6	0.20-0.22	4.5-6.0	Low----------	0.37			
	26-47	35-42	1.35-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37			
	47-60	22-35	1.50-1.70	0.06-0.2	0.14-0.18	5.6-7.3	Moderate-----	0.37			
27B--------------- Clafork	0-11	12-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.32	3	6	2-3
	11-39	32-50	1.25-1.50	0.2-0.6	0.12-0.17	4.5-6.5	High---------	0.43			
	39-59	15-35	1.30-1.70	0.2-0.6	0.10-0.14	5.1-7.8	Moderate-----	0.43			
	59-72	15-35	1.30-1.70	0.2-0.6	0.08-0.11	5.6-7.8	Moderate-----	0.32			
	72-76	30-50	1.20-1.60	0.6-2.0	0.06-0.09	5.6-7.8	Moderate-----	0.32			
27B2, 27C2-------- Clafork	0-8	22-30	1.30-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.32	3	7	2-3
	8-24	32-50	1.25-1.50	0.2-0.6	0.12-0.17	4.5-6.5	High---------	0.43			
	24-49	15-35	1.30-1.70	0.2-0.6	0.10-0.14	5.1-7.8	Moderate-----	0.43			
	49-60	15-35	1.30-1.70	0.2-0.6	0.08-0.11	5.6-7.8	Moderate-----	0.32			
28A--------------- Dameron	0-8	20-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	4	6	2-4
	8-28	20-32	1.25-1.40	0.6-2.0	0.18-0.24	5.1-7.3	Moderate-----	0.32			
	28-60	27-32	1.20-1.55	0.6-2.0	0.04-0.10	5.6-7.3	Low----------	0.28			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
29---------------- Darwin	0-10	40-45	1.20-1.40	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28	5	4	2-4
	10-45	45-60	1.30-1.50	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28			
	45-60	30-55	1.40-1.60	0.06-0.2	0.10-0.20	6.6-8.4	High---------	0.28			
30---------------- Dockery	0-7	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	2-4
	7-60	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Moderate-----	0.43			
32A--------------- Crestmeade	0-11	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	3	6	2-4
	11-18	15-30	1.30-1.45	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.43			
	18-34	42-60	1.30-1.45	0.06-0.2	0.14-0.17	5.1-6.5	High---------	0.32			
	34-52	27-42	1.35-1.50	0.2-0.6	0.14-0.20	5.1-7.3	High---------	0.32			
	52-60	15-30	1.30-1.50	0.2-0.6	0.16-0.20	5.6-7.3	Moderate-----	0.43			
32B2-------------- Crestmeade	0-7	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	3	6	2-4
	7-24	42-60	1.30-1.45	0.06-0.2	0.14-0.17	5.1-6.5	High---------	0.32			
	24-44	27-42	1.35-1.50	0.2-0.6	0.14-0.20	5.1-7.3	High---------	0.32			
	44-60	15-30	1.30-1.50	0.2-0.6	0.16-0.20	5.6-7.3	Moderate-----	0.43			
33---------------- Eudora	0-17	5-18	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.8	Low----------	0.32	5	5	2-4
	17-60	5-18	1.35-1.50	0.6-2.0	0.17-0.22	6.6-8.4	Low----------	0.43			
34D--------------- Eldon	0-6	15-27	1.40-1.55	2.0-6.0	0.13-0.18	4.5-7.3	Low----------	0.24	2	8	2-4
	6-18	24-40	1.35-1.45	0.6-2.0	0.05-0.14	4.5-7.3	Moderate-----	0.24			
	18-28	35-60	1.35-1.45	0.6-2.0	0.03-0.08	4.5-7.3	Moderate-----	0.24			
	28-60	35-95	1.35-1.45	0.6-2.0	0.10-0.14	4.5-7.8	Moderate-----	0.24			
35A, 35B---------- Freeburg	0-14	12-25	1.20-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	6	.5-1
	14-50	25-35	1.40-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	50-60	25-32	1.35-1.50	0.2-0.6	0.16-0.20	4.5-7.3	Moderate-----	0.37			
38B2-------------- Glensted	0-8	18-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	3	6	2-3
	8-14	40-50	1.30-1.45	0.06-0.2	0.11-0.13	5.1-6.5	High---------	0.32			
	14-33	40-50	1.30-1.45	0.06-0.2	0.09-0.13	5.1-6.5	High---------	0.32			
	33-44	27-44	1.30-1.45	0.2-0.6	0.11-0.20	5.6-7.3	Moderate-----	0.32			
	44-60	27-35	1.30-1.45	0.6-2.0	0.15-0.20	5.6-7.8	Moderate-----	0.32			
40C, 40D---------- Goss	0-6	18-27	1.10-1.40	0.6-2.0	0.22-0.24	4.5-6.5	Low----------	0.37	2	8	1-2
	6-18	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.10			
	18-60	35-80	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
40F--------------- Goss	0-4	12-25	1.20-1.50	2.0-6.0	0.04-0.10	4.5-6.0	Low----------	0.24	2	8	1-2
	4-29	25-35	1.40-1.70	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.24			
	29-44	35-60	1.35-1.60	0.6-2.0	0.04-0.08	4.5-6.0	Moderate-----	0.24			
	44-60	45-85	1.10-1.40	0.6-2.0	0.09-0.12	4.5-7.3	Moderate-----	0.24			
41---------------- Grable	0-6	10-27	1.20-1.30	0.6-2.0	0.22-0.24	7.4-8.4	Moderate-----	0.32	4	4L	1-2
	6-23	10-20	1.20-1.40	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.43			
	23-39	5-10	1.20-1.40	6.0-20	0.04-0.08	7.4-8.4	Low----------	0.17			
	39-60	5-20	1.20-1.40	2.0-6.0	0.08-0.20	7.4-8.4	Low----------	0.32			
46---------------- Haynie	0-9	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37	5	4L	1-2
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37			
47:											
Haynie-----------	0-9	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37	5	4L	1-2
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.37			
Waldron----------	0-9	28-40	1.30-1.40	0.2-0.6	0.14-0.18	6.6-7.8	High---------	0.37	5	4	2-4
	9-48	35-50	1.30-1.50	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
	48-60	15-20	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	Low----------	0.43			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
48B--------------- Higginsville	0-20	18-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low-----------	0.37	5	6	3-4
	20-27	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	27-47	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	47-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37			
50C--------------- Bunceton	0-8	15-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	2-4
	8-11	20-35	1.35-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.37			
	11-31	15-35	1.35-1.55	0.2-0.6	0.10-0.15	5.1-7.3	Low-----------	0.28			
	31-48	25-40	1.35-1.55	0.6-2.0	0.05-0.15	6.1-7.3	Moderate-----	0.24			
	48-60	40-60	1.30-1.50	0.2-0.6	0.07-0.11	6.1-7.3	--------------	0.24			
50C2, 50D2-------- Bunceton	0-8	15-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	2-4
	8-25	20-35	1.35-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.37			
	25-45	15-35	1.35-1.55	0.2-0.6	0.10-0.15	5.1-7.3	Low-----------	0.28			
	45-54	25-40	1.35-1.55	0.6-2.0	0.05-0.15	6.1-7.3	Moderate-----	0.24			
	54-60	40-60	1.30-1.50	0.2-0.6	0.07-0.11	6.1-7.3	--------------	0.24			
51C2-------------- Knox	0-8	18-27	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	2-3
	8-48	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	48-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.43			
52C2-------------- Ladoga	0-8	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.32	5	6	2-3
	8-36	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	36-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
53---------------- Buckney	0-10	10-16	1.20-1.50	2.0-6.0	0.08-0.12	6.6-7.8	Low-----------	0.20	4	3	1-2
	10-15	4-16	1.20-1.50	2.0-6.0	0.04-0.12	6.6-7.8	Low-----------	0.20			
	15-60	2-8	1.20-1.40	6.0-20	0.02-0.06	6.6-8.4	Low-----------	0.17			
54A--------------- Leslie	0-9	12-20	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	5	5	2-4
	9-14	12-18	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Low-----------	0.37			
	14-22	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	22-36	35-48	1.20-1.40	0.06-0.2	0.11-0.20	5.1-7.3	High---------	0.37			
	36-60	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.37			
54B--------------- Leslie	0-11	12-20	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	5	5	2-4
	11-16	12-18	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Low-----------	0.37			
	16-20	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	20-48	35-48	1.20-1.40	0.06-0.2	0.11-0.20	5.1-7.3	High---------	0.37			
	48-60	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Low-----------	0.37			
54B2-------------- Leslie	0-6	12-20	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	5	5	2-4
	6-10	12-18	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	--------------	----			
	10-39	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-6.0	Moderate-----	0.37			
	39-60	20-35	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Low-----------	0.37			
56---------------- Leta	0-12	27-40	1.30-1.45	0.2-0.6	0.21-0.23	6.6-7.8	Moderate-----	0.28	5	4L	2-4
	12-26	35-50	1.30-1.50	0.06-0.2	0.11-0.19	6.6-7.8	High---------	0.28			
	26-60	7-27	1.30-1.50	0.6-2.0	0.14-0.22	7.4-8.4	Low-----------	0.28			
60F--------------- Lindley	0-23	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low-----------	0.32	5	6	1-2
	23-43	25-35	1.35-1.55	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32			
	43-60	18-32	1.40-1.60	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32			
64B--------------- McGirk	0-17	15-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low-----------	0.43	3	6	1-2
	17-22	27-40	1.30-1.40	0.2-0.6	0.18-0.20	4.5-5.5	Moderate-----	0.43			
	22-59	35-50	1.25-1.35	0.06-0.2	0.10-0.18	4.5-6.0	High---------	0.32			
	59-60	20-35	1.30-1.40	0.2-0.6	0.14-0.18	4.5-6.0	Moderate-----	0.37			
66C--------------- Monfro	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	1-2
	8-15	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	15-42	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	42-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
66C2, 66D2------- Menfro	0-7	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	1-2
	7-39	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	39-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
66F-------------- Menfro	0-13	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	1-2
	13-40	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	40-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
67C2------------- Menfro	0-7	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	1-2
	7-39	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	39-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
70C:											
Moko------------	0-2	27-35	1.25-1.50	0.6-2.0	0.08-0.14	6.6-7.8	Low-----------	0.24	1	8	2-4
	2-11	18-35	1.25-1.60	0.6-2.0	0.03-0.14	6.6-7.8	Low-----------	0.28			
	11	---	---	0.00-0.2	---	---	-------------	----			
Rock outcrop.											
70F:											
Moko------------	0-3	18-27	1.25-1.60	0.6-2.0	0.07-0.13	6.6-7.8	Low-----------	0.24	1	8	2-4
	3-9	18-35	1.25-1.60	0.6-2.0	0.03-0.14	6.6-7.8	Low-----------	0.28			
	9	---	---	0.00-0.2	---	---	-------------	----			
Rock outcrop.											
72--------------- Moniteau	0-10	18-27	1.20-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Low-----------	0.37	5	6	1-2
	10-19	18-27	1.20-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43			
	19-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.0	Moderate-----	0.43			
75--------------- Shannondale	0-19	15-27	1.20-1.30	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	5	6	1-2
	19-47	15-30	1.20-1.50	0.6-2.0	0.18-0.22	4.5-7.3	Moderate-----	0.32			
	47-60	27-35	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Moderate-----	0.43			
76--------------- Motark	0-8	10-18	1.20-1.30	0.6-2.0	0.21-0.23	6.1-7.8	Low-----------	0.32	5	5	1-2
	8-60	10-18	1.20-1.30	0.6-2.0	0.21-0.23	6.6-7.8	Low-----------	0.32			
80B-------------- Pershing	0-20	20-27	1.30-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6	2-3
	20-27	27-35	1.30-1.40	0.2-0.6	0.20-0.22	5.1-6.0	Moderate-----	0.43			
	27-46	35-48	1.35-1.45	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.43			
	46-60	24-40	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.43			
80B2, 80C2------- Pershing	0-7	20-27	1.30-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6	2-3
	7-14	27-35	1.30-1.40	0.2-0.6	0.20-0.22	5.1-6.0	Moderate-----	0.43			
	14-42	35-48	1.35-1.45	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.43			
	42-60	24-40	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.43			
82--------------- Sarpy	0-6	2-5	1.20-1.50	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.15	5	1	.5-1
	6-60	2-5	1.20-1.50	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.15			
86, 87A---------- Speed	0-14	12-22	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	5	2-3
	14-27	12-20	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Low-----------	0.43			
	27-35	18-30	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Moderate-----	0.43			
	35-60	20-32	1.30-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.43			
88--------------- Sturkie	0-10	10-27	1.20-1.40	0.6-2.0	0.16-0.18	5.6-7.8	Low-----------	0.37	5	5	1-3
	10-30	15-35	1.20-1.40	0.6-2.0	0.16-0.18	5.6-7.8	Low-----------	0.37			
	30-50	15-35	1.20-1.40	0.6-2.0	0.12-0.14	6.1-8.4	Low-----------	0.37			
	50-60	5-35	1.20-1.40	0.6-2.0	0.09-0.18	6.1-8.4	Low-----------	0.37			
90B-------------- Wakenda	0-19	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	3-4
	19-45	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28			
	45-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
90C2------------- Wakenda	0-10	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	3-4
	10-43	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28			
	43-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43			
92--------------- Waldron	0-9	28-40	1.30-1.40	0.2-0.6	0.14-0.18	6.6-7.8	High---------	0.37	5	4	2-4
	9-48	35-50	1.30-1.50	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
	48-60	15-20	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	Low-----------	0.43			
93B-------------- Cotton	0-14	12-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	3	5	1-2
	14-19	25-35	1.35-1.55	0.2-0.6	0.16-0.22	5.1-7.3	Low-----------	0.43			
	19-33	35-55	1.30-1.55	0.06-0.2	0.14-0.20	5.1-7.3	Moderate-----	0.32			
	33-54	12-32	1.40-1.70	0.06-0.2	0.08-0.15	5.1-7.3	Low-----------	0.24			
	54-60	25-60	1.25-1.55	0.2-0.6	0.05-0.13	6.1-7.3	Moderate-----	0.24			
93B2, 93C2, 93D2- Cotton	0-7	12-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	3	5	1-2
	7-11	25-35	1.35-1.55	0.2-0.6	0.16-0.22	5.1-7.3	Low-----------	0.43			
	11-25	35-55	1.30-1.55	0.06-0.2	0.14-0.20	5.1-7.3	Moderate-----	0.32			
	25-54	12-32	1.40-1.70	0.06-0.2	0.08-0.15	5.1-7.3	Low-----------	0.24			
	54-60	25-60	1.25-1.55	0.2-0.6	0.05-0.13	6.1-7.3	Moderate-----	0.24			
94B-------------- Weller	0-20	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6	2-3
	20-50	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	50-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.5	High---------	0.43			
94B2, 94C2, 94D2- Weller	0-7	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6	1-2
	7-34	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	34-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.5	High---------	0.43			
95C-------------- Wrengart	0-10	12-27	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37	5	5	1-2
	10-30	20-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.43			
	30-50	18-32	1.50-1.70	0.2-0.6	0.10-0.15	5.1-7.3	Low-----------	0.43			
	50-60	18-32	1.30-1.50	0.6-2.0	0.05-0.10	5.1-7.3	Moderate-----	0.09			
95C2, 95D2, 95E-- Wrengart	0-6	12-27	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37	5	5	1-2
	6-26	20-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.43			
	26-45	18-32	1.50-1.70	0.2-0.6	0.10-0.15	5.1-7.3	Low-----------	0.43			
	45-60	18-32	1.30-1.50	0.6-2.0	0.05-0.10	5.1-7.3	Moderate-----	0.09			
	60-80	40-80	1.30-1.50	0.2-0.6	0.08-0.12	5.1-7.8	Moderate-----	0.19			
96C-------------- Winfield	0-14	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	6	1-2
	14-24	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	24-50	24-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	50-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.37			
96C2, 96D2------- Winfield	0-8	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	6	1-2
	8-18	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	18-56	24-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	56-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.37			
99--------------- Zook	0-26	35-40	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.28	5	4	4-7
	26-48	35-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.3	High---------	0.28			
	48-60	25-45	1.30-1.45	0.06-0.2	0.11-0.20	5.6-7.3	High---------	0.28			
100. Pits											

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the te
< means less than; > means more than. Absence of an entry indicates that the feature is not a concern or tha
estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Unc s
					Ft			In			
10---------------- Ackmore	B	Occasional	Very brief or brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Hig
11B, 11B2, 11C2--- Arisburg	B	None--------	---	---	1.5-2.5	Perched	Nov-Apr	>60	---	High-----	Hig
13B--------------- Jemerson	B	Rare--------	---	---	3.5-5.0	Apparent	Nov-Apr	>60	---	High-----	Mod
15D2, 15F--------- Newcomer	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low
17C2, 17D2, 17E2-- Bluelick	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Hig
20---------------- Bremer	C	Occasional	Very brief	Nov-May	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	Mod
25A--------------- Chauncey	C	None--------	---	---	0-2.0	Perched	Nov-Jun	>60	---	High-----	Hig
27B, 27B2, 27C2--- Clafork	C	None--------	---	---	1.0-2.5	Perched	Nov-Apr	>60	---	Moderate	Hig
28A--------------- Dameron	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low
29---------------- Darwin	D	Occasional	Brief or long.	Nov-Jun	+1-2.0	Apparent	Nov-Jun	>60	---	Moderate	Hig
30---------------- Dockery	C	Frequent----	Brief-----	Nov-Jun	1.5-3.0	Apparent	Nov-Jun	>60	---	High-----	Mod
32A, 32B2--------- Crestmeade	D	None--------	---	---	0.5-1.5	Perched	Nov-Apr	>60	---	High-----	Hig
33---------------- Eudora	B	Occasional	Brief-----	Nov-Jun	>6.0	---	---	>60	---	High-----	Low
34D--------------- Eldon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Mod
35A--------------- Freeburg	C	Occasional	Brief-----	Nov-May	1.0-2.5	Perched	Nov-May	>60	---	High-----	Hig

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Unc
					Ft			In			
35B---------------- Freeburg	C	Rare---------	---	---	1.0-2.5	Perched	Nov-May	>60	---	High-----	Hig
38B2--------------- Glensted	D	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	High-----	Hig
40C, 40D---------- Goss	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moc
40F---------------- Goss	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low
41----------------- Grable	B	Occasional	Brief-----	Nov-May	>6.0	---	---	>60	---	Low------	Low
46----------------- Haynie	B	Occasional	Brief-----	Nov-May	3.0-6.0	Apparent	Nov-May	>60	---	High-----	Low
47:											
Haynie------------	B	Occasional	Brief or long.	Nov-May	3.0-6.0	Apparent	Nov-May	>60	---	High-----	Low
Waldron-----------	D	Occasional	Brief or long.	Nov-May	1.0-2.5	Apparent	Nov-May	>60	---	High-----	Hig
48B---------------- Higginsville	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High-----	Moc
50C, 50C2, 50D2--- Bunceton	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moc
51C2--------------- Knox	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low
52C2--------------- Ladoga	B	None---------	---	---	4.0-6.0	Perched	Nov-Apr	>60	---	Moderate	Moc
53----------------- Buckney	B	Occasional	Brief-----	Nov-Jun	>6.0	---	---	>60	---	Low------	Low
54A---------------- Leslie	D	None---------	---	---	0-1.5	Perched	Nov-May	>60	---	High-----	Hig
54B, 54B2--------- Leslie	D	None---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	High-----	Hig
56----------------- Leta	C	Occasional	Brief-----	Nov-Jun	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	Hig

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Ri[illegible]
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Unc[illegible] s[illegible]
					Ft			In			
60F---------------- Lindley	C	None---------	---	---	3.5-5.0	Perched	Nov-Apr	>60	---	Moderate	Mod
64B---------------- McGirk	C	None---------	---	---	0.5-2.0	Perched	Nov-May	>60	---	High-----	Hig
66C, 66C2, 66D2, 66F, 67C2--------- Menfro	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low
70C, 70F: Moko---------------	D	None---------	---	---	>6.0	---	---	6-20	Hard	---	Low
Rock outcrop.											
72----------------- Moniteau	D	Occasional	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	Hig
75----------------- Shannondale	C	Rare---------	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	High-----	Low
76----------------- Motark	B	Occasional	Brief-----	Nov-May	2.5-4.0	Apparent	Nov-May	>60	---	High-----	Low
80B, 80B2, 80C2--- Pershing	C	None---------	---	---	2.0-4.0	Perched	Nov-Apr	>60	---	High-----	Hig
82----------------- Sarpy	A	Occasional	Brief or long.	Nov-Jun	>6.0	---	---	>60	---	Low------	Low
86----------------- Speed	C	Occasional	Brief-----	Nov-May	1.0-2.5	Apparent	Nov-May	>60	---	High-----	Hig
87A---------------- Speed	C	Rare---------	---	---	1.0-2.5	Apparent	Nov-May	>60	---	High-----	Hig
88----------------- Sturkie	B	Frequent----	Brief-----	Nov-May	>6.0	---	---	>60	---	---	Low
90B, 90C2---------- Wakenda	B	None---------	---	---	4.0-6.0	Perched	Nov-May	>60	---	High-----	Low
92----------------- Waldron	D	Occasional	Brief-----	Nov-May	1.0-2.5	Apparent	Nov-May	>60	---	High-----	Hig
93B, 93B2, 93C2, 93D2-------------- Cotton	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	Hig

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Unc s
					Ft			In			
94B, 94B2, 94C2, 94D2-------------- Weller	C	None---------	---	---	2.0-4.0	Perched	Nov-Apr	>60	---	High-----	Hig
95C, 95C2, 95D2, 95E-------------- Wrengart	C	None---------	---	---	2.0-3.5	Perched	Nov-Apr	>60	---	Moderate	Mod
96C, 96C2, 96D2--- Winfield	B	None---------	---	---	2.5-4.0	Perched	Nov-Apr	>60	---	High-----	Mod
99---------------- Zook	C	Occasional	Brief-----	Nov-Jun	0.-2.0	Apparent	Nov-Jun	>60	---	High-----	Hig
100. Pits											

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Arisburg	Fine, montmorillonitic, mesic Aquertic Argiudolls
Bluelick	Fine, mixed, mesic Typic Paleudalfs
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Buckney	Sandy, mixed, mesic Typic Hapludolls
Bunceton	Fine-silty, mixed, mesic Mollic Hapludalfs
Chauncey	Fine, montmorillonitic, mesic Typic Argialbolls
Clafork	Fine, montmorillonitic, mesic Aquertic Hapludalfs
Cotton	Fine, montmorillonitic, mesic Aquic Hapludalfs
Crestmeade	Fine, montmorillonitic, mesic Vertic Argialbolls
Dameron	Fine-loamy, mixed, mesic Cumulic Hapludolls
Darwin	Fine, montmorillonitic, mesic Vertic Endoaquolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Eldon	Clayey-skeletal, mixed, mesic Mollic Paleudalfs
Eudora	Coarse-silty, mixed, mesic Fluventic Hapludolls
Freeburg	Fine-silty, mixed, mesic Aquic Hapludalfs
Glensted	Fine, montmorillonitic, mesic Vertic Albaqualfs
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Higginsville	Fine-silty, mixed, mesic Aquic Argiudolls
Jemerson	Fine-silty, mixed, mesic Typic Hapludalfs
Knox	Fine-silty, mixed, mesic Mollic Hapludalfs
Ladoga	Fine, montmorillonitic, mesic Vertic Hapludalfs
Leslie	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Leta	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
McGirk	Fine, montmorillonitic, mesic Typic Endoaqualfs
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Moko	Loamy-skeletal, mixed, mesic Lithic Hapludolls
Moniteau	Fine-silty, mixed, mesic Typic Endoaqualfs
Motark	Coarse-silty, mixed, nonacid, mesic Oxyaquic Udifluvents
Newcomer	Fine-loamy, mixed, mesic Mollic Hapludalfs
Pershing	Fine, montmorillonitic, mesic Vertic Epiaqualfs
Sarpy	Mixed, mesic Typic Udipsamments
Shannondale	Fine-silty, mixed, mesic Aquic Argiudolls
Speed	Fine-silty, mixed, mesic Argiaquic Argialbolls
Sturkie	Fine-silty, mixed, mesic Cumulic Hapludolls
Wakenda	Fine-silty, mixed, mesic Typic Argiudolls
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Weller	Fine, montmorillonitic, mesic Aquertic Chromic Hapludalfs
Winfield	Fine-silty, mixed, mesic Oxyaquic Hapludalfs
Wrengart	Fine-silty, mixed, mesic Oxyaquic Hapludalfs
Zook	Fine, montmorillonitic, mesic Cumulic Vertic Endoaquolls

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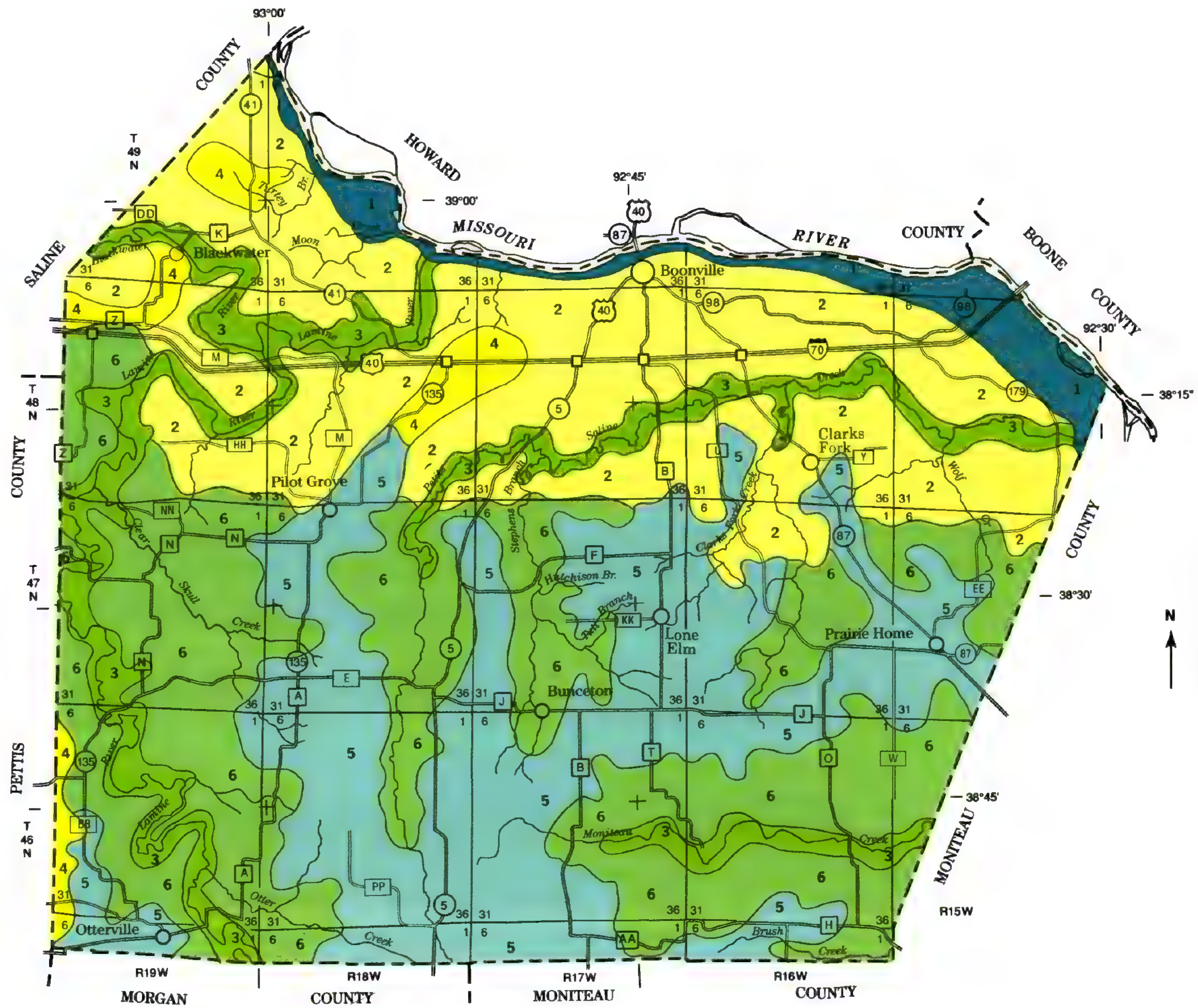
SOIL LEGEND*

1	HAYNIE-WALDRON-LETA association
2	MENFRO association
3	DOCKERY-SPEED-MONITEAU association
4	ARISBURG association
5	CLAFORK-LESLIE-CRESTMEADE association
6	GOSS-WRENGART-BLUELICK association

* The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1993



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI DEPARTMENT OF NATURAL RESOURCES
MISSOURI AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

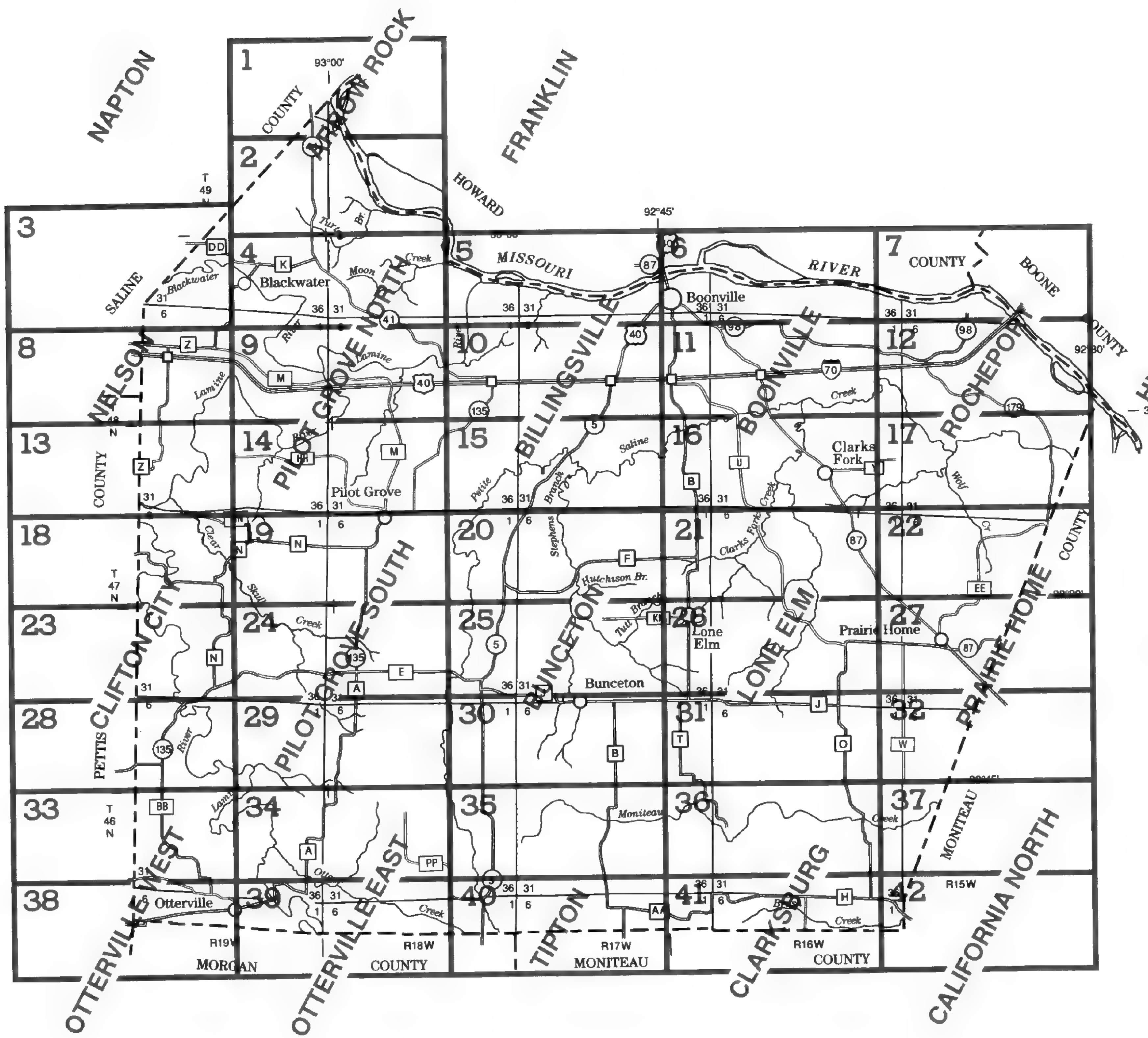
COOPER COUNTY, MISSOURI

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

COOPER COUNTY, MISSOURI

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded.

SYMBOL	NAME
10	Ackmore silt loam, occasionally flooded
11B	Arisburg silt loam, 1 to 5 percent slopes
11B2	Arisburg silt loam, 2 to 5 percent slopes, eroded
11C2	Arisburg silt loam, 5 to 9 percent slopes, eroded
13B	Jemerson silt loam, 2 to 5 percent slopes, rarely flooded
15D2	Newcomer silt loam, 9 to 14 percent slopes, eroded
15F	Newcomer silt loam, 14 to 35 percent slopes
17C2	Bluelick silt loam, 3 to 8 percent slopes, eroded
17D2	Bluelick silt loam, 8 to 15 percent slopes, eroded
17E2	Bluelick silt loam, 15 to 25 percent slopes, eroded
20	Bremer silt loam, occasionally flooded
25A	Chauncey silt loam, 0 to 3 percent slopes
27B	Clafork silt loam, 2 to 5 percent slopes
27B2	Clafork silt loam, 2 to 5 percent slopes, eroded
27C2	Clafork silt loam, 5 to 8 percent slopes, eroded
28A	Dameron silt loam, 0 to 3 percent slopes, occasionally flooded
29	Darwin silty clay, occasionally flooded
30	Dockery silt loam, frequently flooded
32A	Crestmeade silt loam, 0 to 2 percent slopes
32B2	Crestmeade silt loam, 1 to 4 percent slopes, eroded
33	Eudora loam, sandy substratum, occasionally flooded
34D	Eldon gravelly silt loam, 8 to 15 percent slopes
35A	Freeburg silt loam, 0 to 2 percent slopes, occasionally flooded
35B	Freeburg silt loam, 1 to 4 percent slopes, rarely flooded
38B2	Glensted silt loam, 2 to 5 percent slopes, eroded
40C	Goss silt loam, 3 to 8 percent slopes
40D	Goss silt loam 8 to 15 percent slopes
40F	Goss gravelly silt loam, 15 to 45 percent slopes, very stony
41	Grable silt loam, loamy substratum, occasionally flooded
46	Haynie silt loam, occasionally flooded
47	Haynie-Waldron complex, occasionally flooded
48B	Higginsville silt loam, 2 to 5 percent slopes
50C	Bunceton silt loam, 3 to 8 percent slopes
50C2	Bunceton silt loam, 3 to 8 percent slopes, eroded
50D2	Bunceton silt loam. 8 to 15 percent slopes, eroded
51C2	Knox silt loam, 3 to 9 percent slopes, eroded
52C2	Ladoga silt loam, 3 to 9 percent slopes, eroded
53	Buckney fine sandy loam, occasionally flooded
54A	Leslie silt loam, terrace, 0 to 2 percent slopes
54B	Leslie silt loam, 1 to 3 percent slopes
54B2	Leslie silt loam, 2 to 5 percent slopes, eroded
56	Leta silty clay loam, occasionally flooded
60F	Lindley silt loam, 14 to 35 percent slopes
64B	McGirk silt loam, 2 to 5 percent slopes
66C	Menfro silt loam, 3 to 9 percent slopes
66C2	Menfro silt loam, 3 to 9 percent slopes, eroded
66D2	Menfro silt loam, 9 to 14 percent slopes, eroded
66F	Menfro silt loam, 14 to 35 percent slopes
67C2	Menfro silt loam, karst, 3 to 9 percent slopes, eroded
70C	Moko-Rock outcrop complex, 3 to 8 percent slopes
70F	Moko-Rock outcrop complex, 8 to 45 percent slopes
72	Moniteau silt loam, occasionally flooded
75	Shannondale silt loam, rarely flooded
76	Motark silt loam, occasionally flooded
80B	Pershing silt loam, 2 to 5 percent slopes
80B2	Pershing silt loam, 2 to 5 percent slopes, eroded
80C2	Pershing silt loam, 5 to 9 percent slopes, eroded
82	Sarpy fine sand, occasionally flooded
86	Speed silt loam, 0 to 2 percent slopes, occasionally flooded
87A	Speed silt loam, 0 to 3 percent slopes, rarely flooded
88	Sturkie silt loam, frequently flooded
90B	Wakenda silt loam, 2 to 5 percent slopes
90C2	Wakenda silt loam, 5 to 9 percent slopes, eroded
92	Waldron silty clay loam, loamy substratum, occasionally flooded
93B	Cotton silt loam, 2 to 5 percent slopes
93B2	Cotton silt loam, 2 to 5 percent slopes, eroded
93C2	Cotton silt loam, 5 to 8 percent slopes, eroded
93D2	Cotton silt loam, 8 to 15 percent slopes, eroded
94B	Weller silt loam, 2 to 5 percent slopes
94B2	Weller silt loam, 2 to 5 percent slopes, eroded
94C2	Weller silt loam, 5 to 9 percent slopes, eroded
94D2	Weller silt loam, 9 to 14 percent slopes, eroded
95C	Wrengart silt loam, 3 to 8 percent slopes
95C2	Wrengart silt loam, 3 to 8 percent slopes, eroded
95D2	Wrengart silt loam, 8 to 15 percent slopes, eroded
95E	Wrengart silt loam, 15 to 25 percent slopes
96C	Winfield silt loam, 3 to 9 percent slopes
96C2	Winfield silt loam, 3 to 9 percent slopes, eroded
96D2	Winfield silt loam, 9 to 14 percent slopes, eroded
99	Zook silty clay loam, occasionally flooded
100	Pits, quarries

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

*STATE COORDINATE TICK 1 890 000 FEET

*LAND DIVISION CORNER (sections and land grants)

ROADS

- *Divided (median shown if scale permits)
- *Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate (173)
- Federal (287)
- State (52)
- County, farm or ranch (1283)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small > 2.5 acres

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label)
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 11B2 11B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot 2 to 5 acres
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

1

N

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COOPER COUNTY, MISSOURI NO. 1

1 3/4 1/2 1/4 0 1 2 MILES

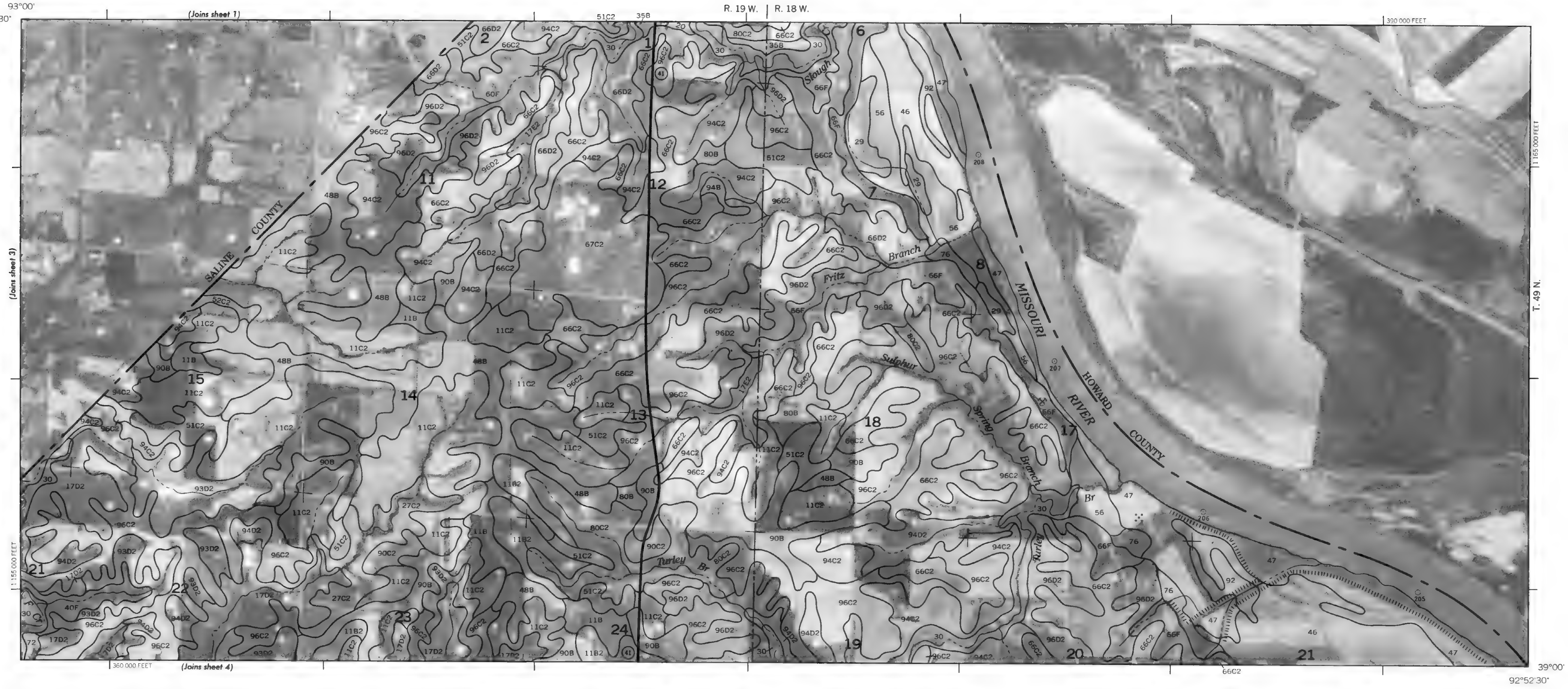
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 2

2

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 2

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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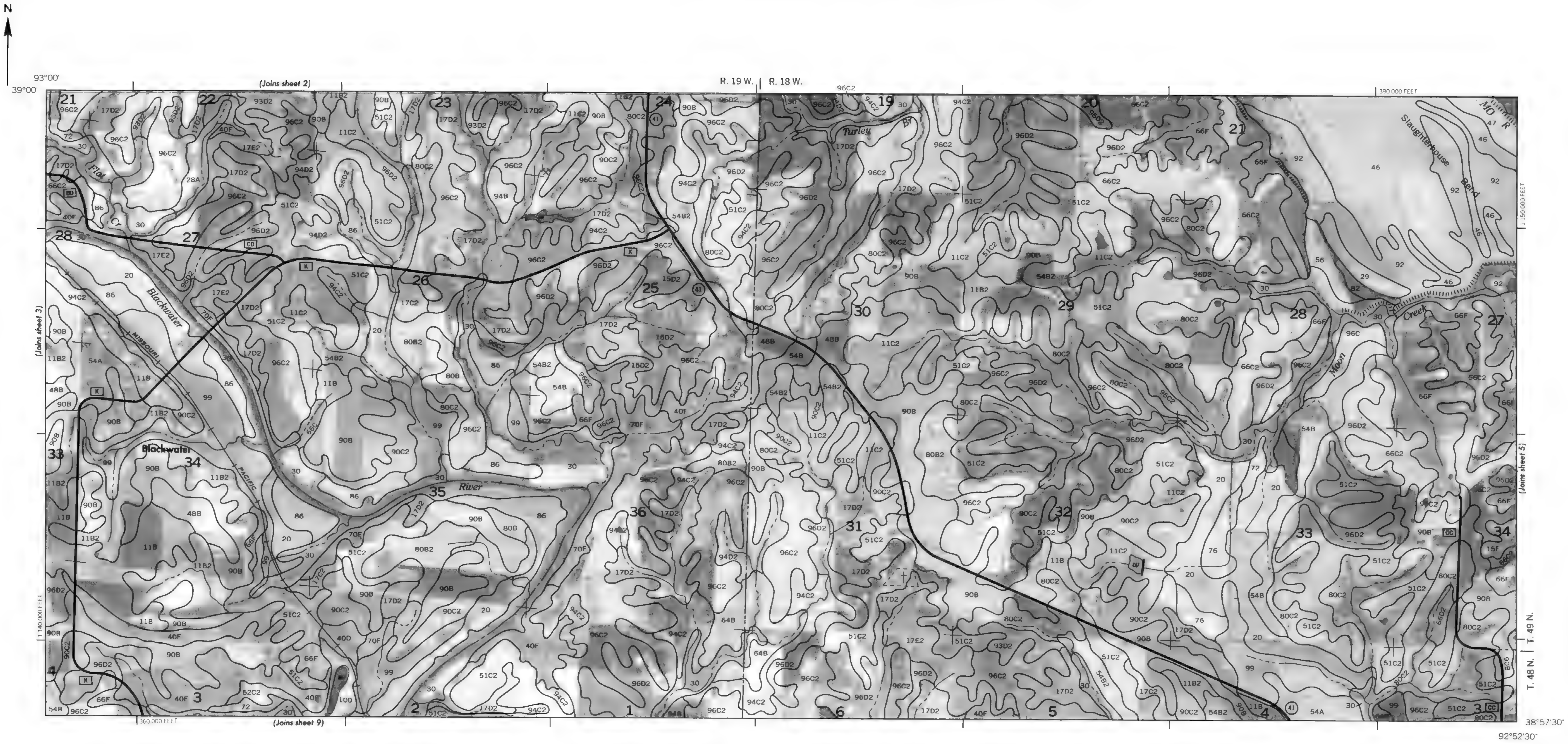
COOPER COUNTY, MISSOURI NO. 3

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 4



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 4

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5

N

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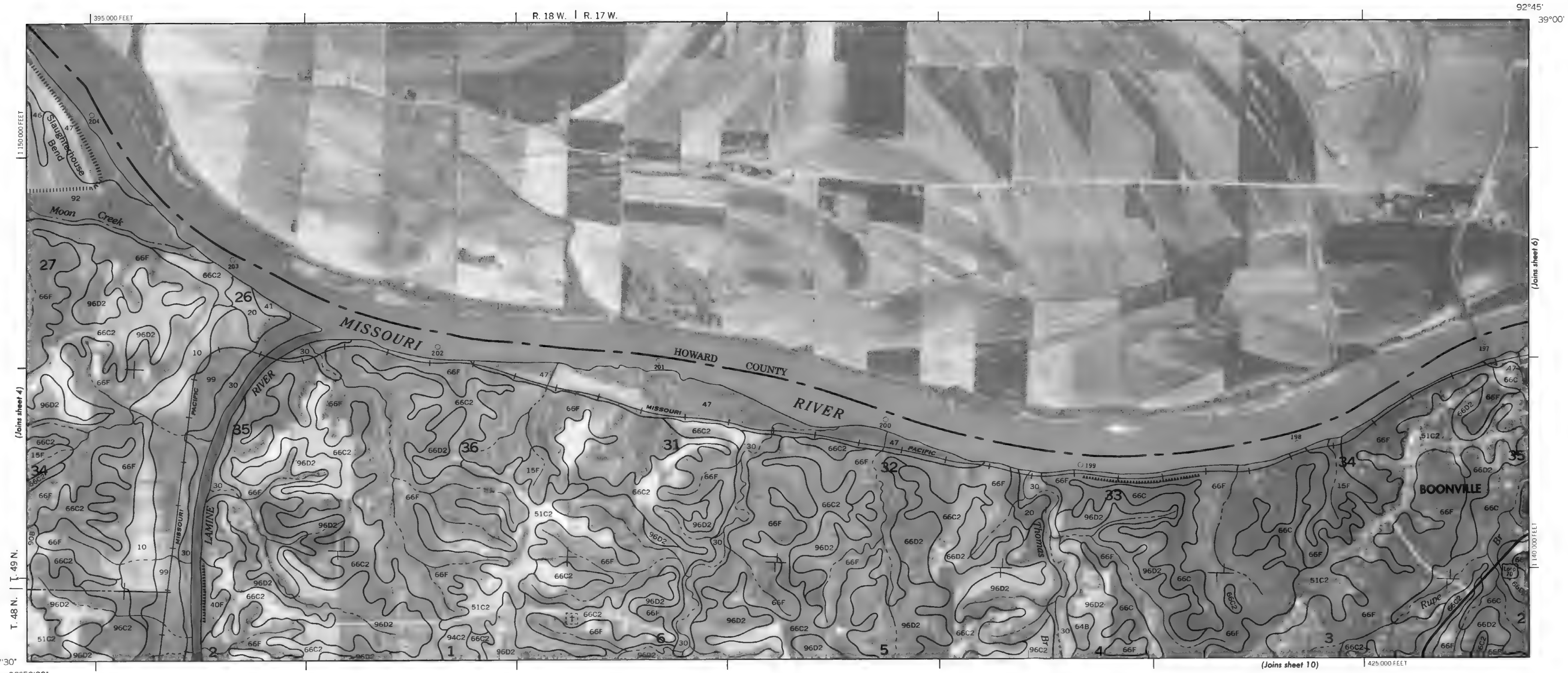
COOPER COUNTY, MISSOURI NO. 5



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 6

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

7

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COOPER COUNTY, MISSOURI NO. 7

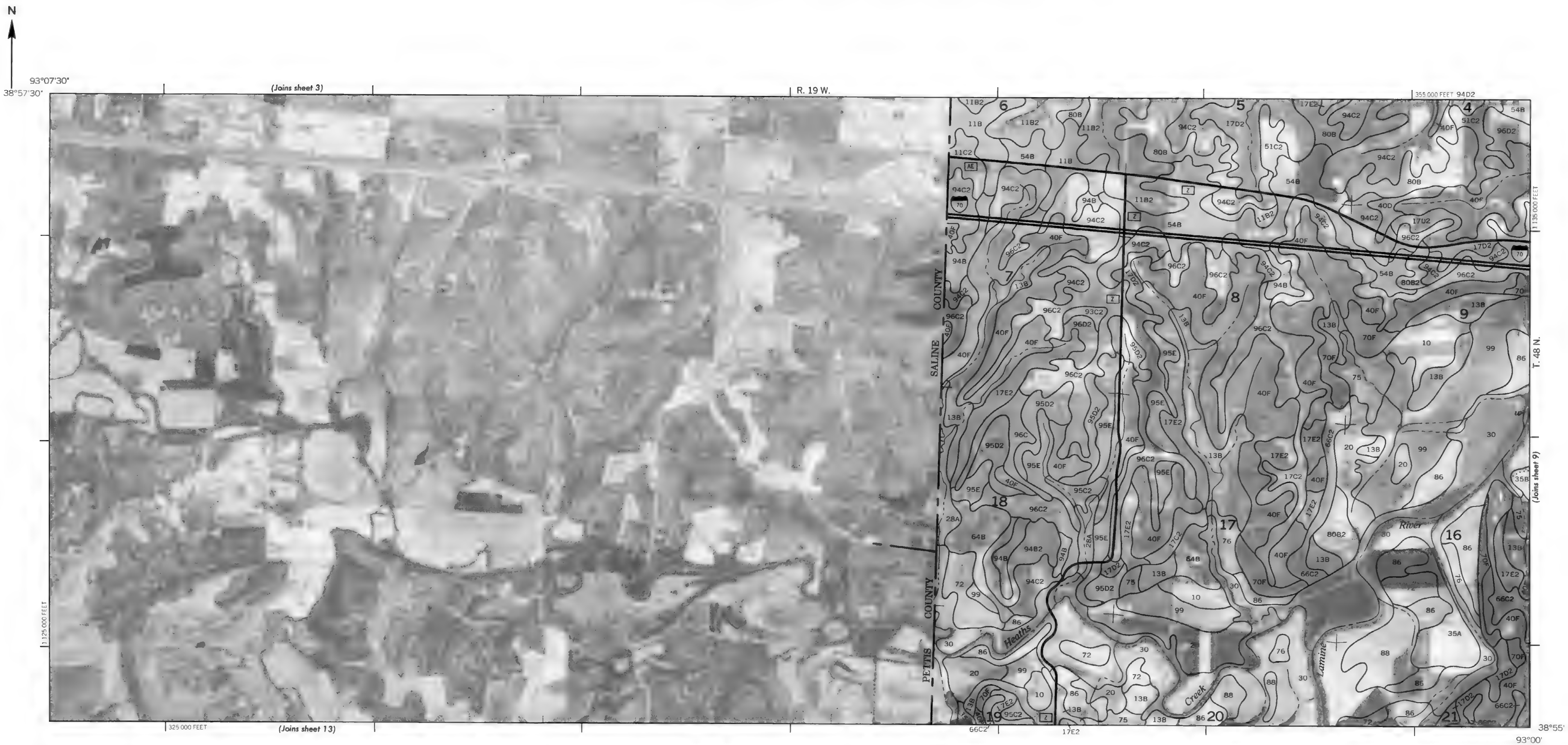
1 3/4 1/2 1/4 0 1 2 MILES

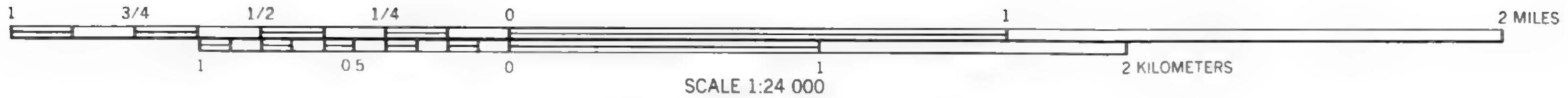
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

8

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 8





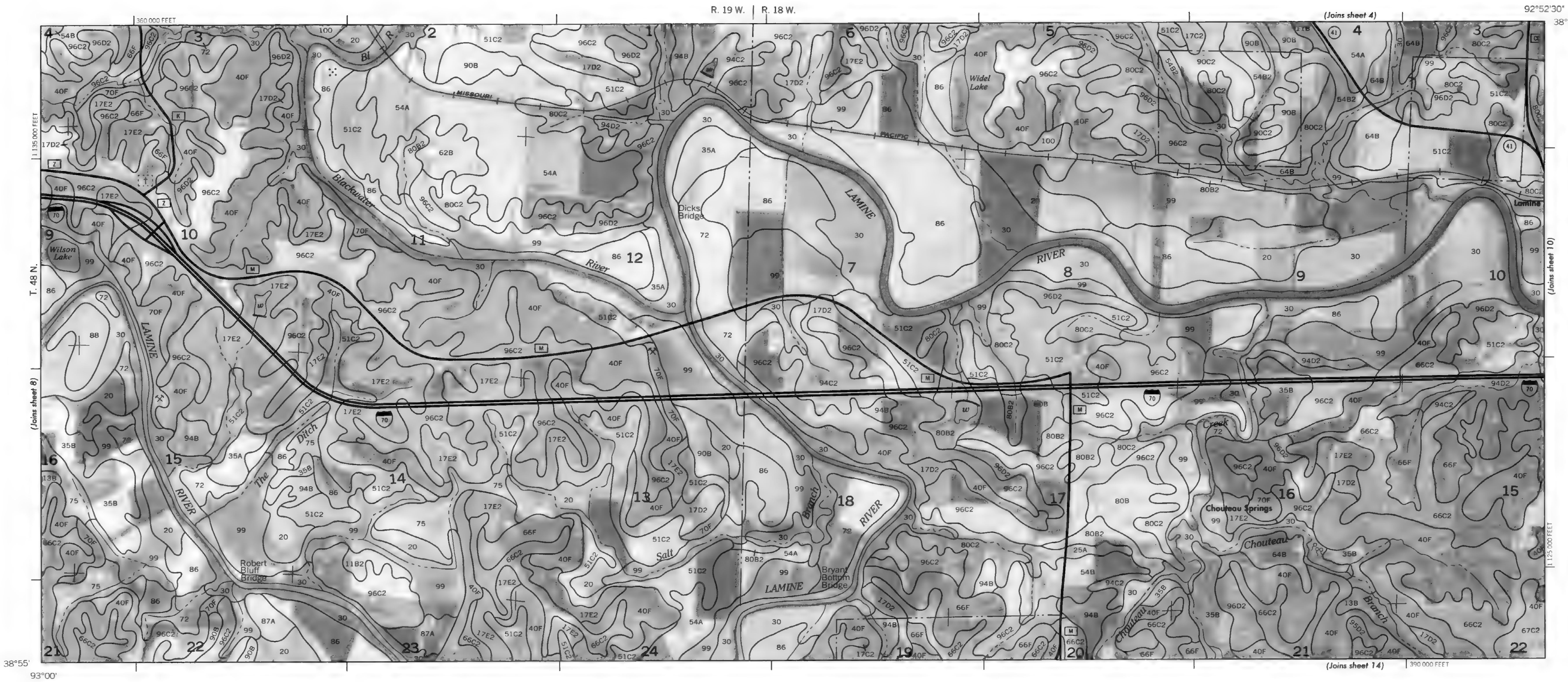
SCALE 1:24 000

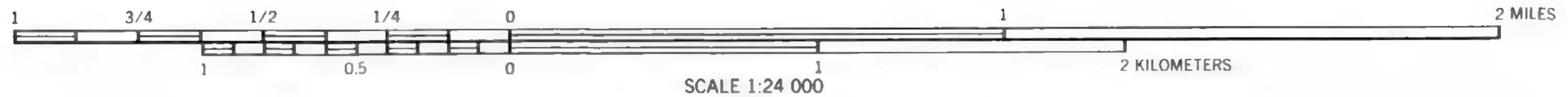
COOPER COUNTY, MISSOURI NO. 8

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

9

N





SCALE 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 9

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 10

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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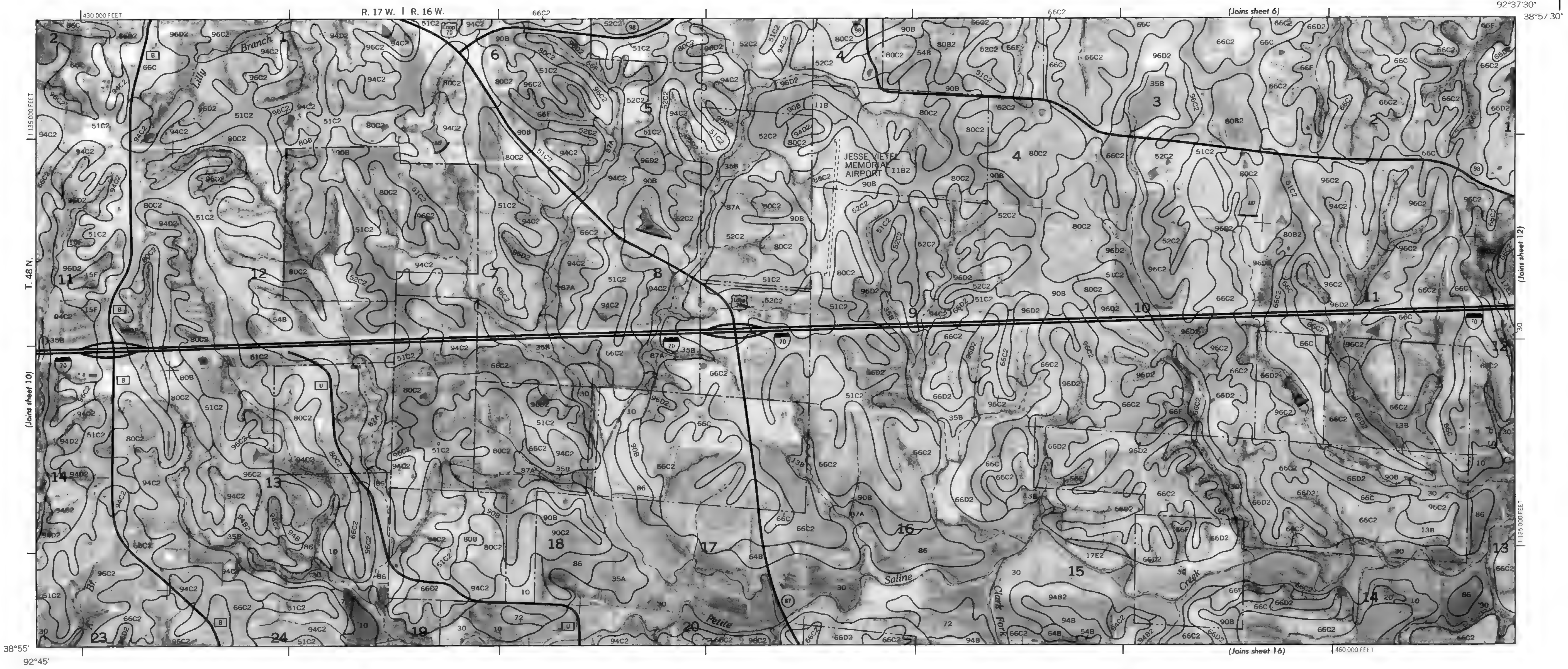
(11)

N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 11

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 12

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

13

N

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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COOPER COUNTY, MISSOURI NO 13

N

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 14

SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

COOPER COUNTY, MISSOURI NO. 14

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

15

N

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COOPER COUNTY, MISSOURI NO. 15

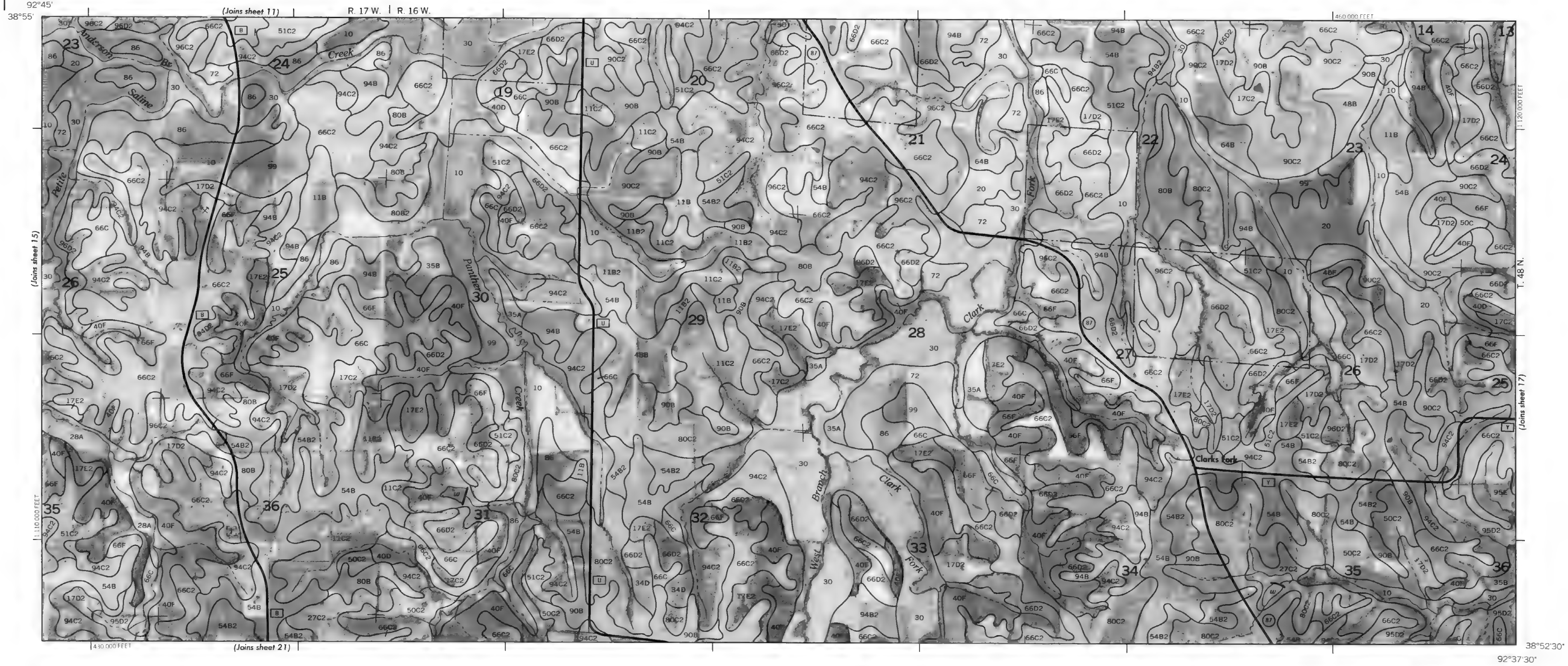
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 16

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 16

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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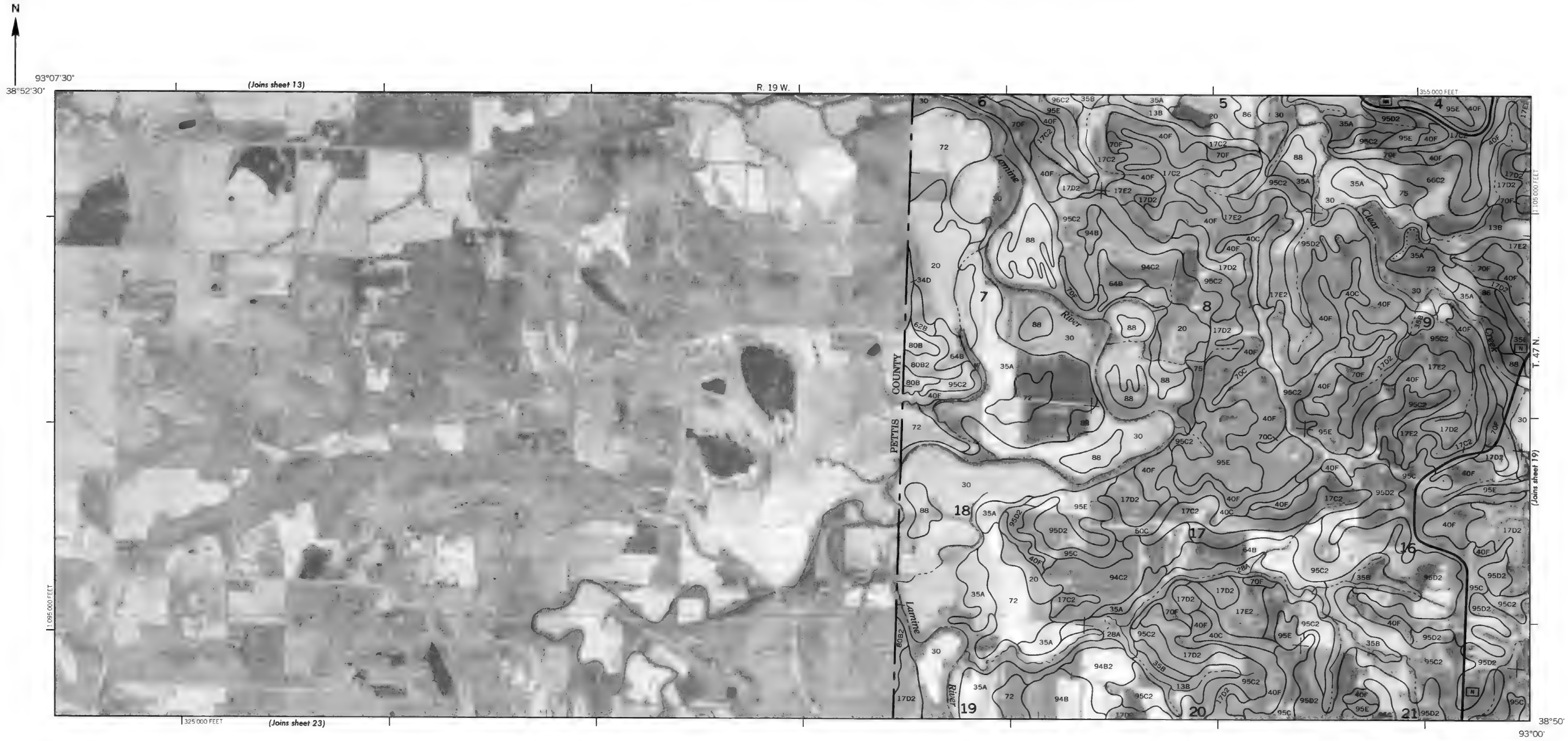
COOPER COUNTY, MISSOURI NO. 17

SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 18



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 18

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

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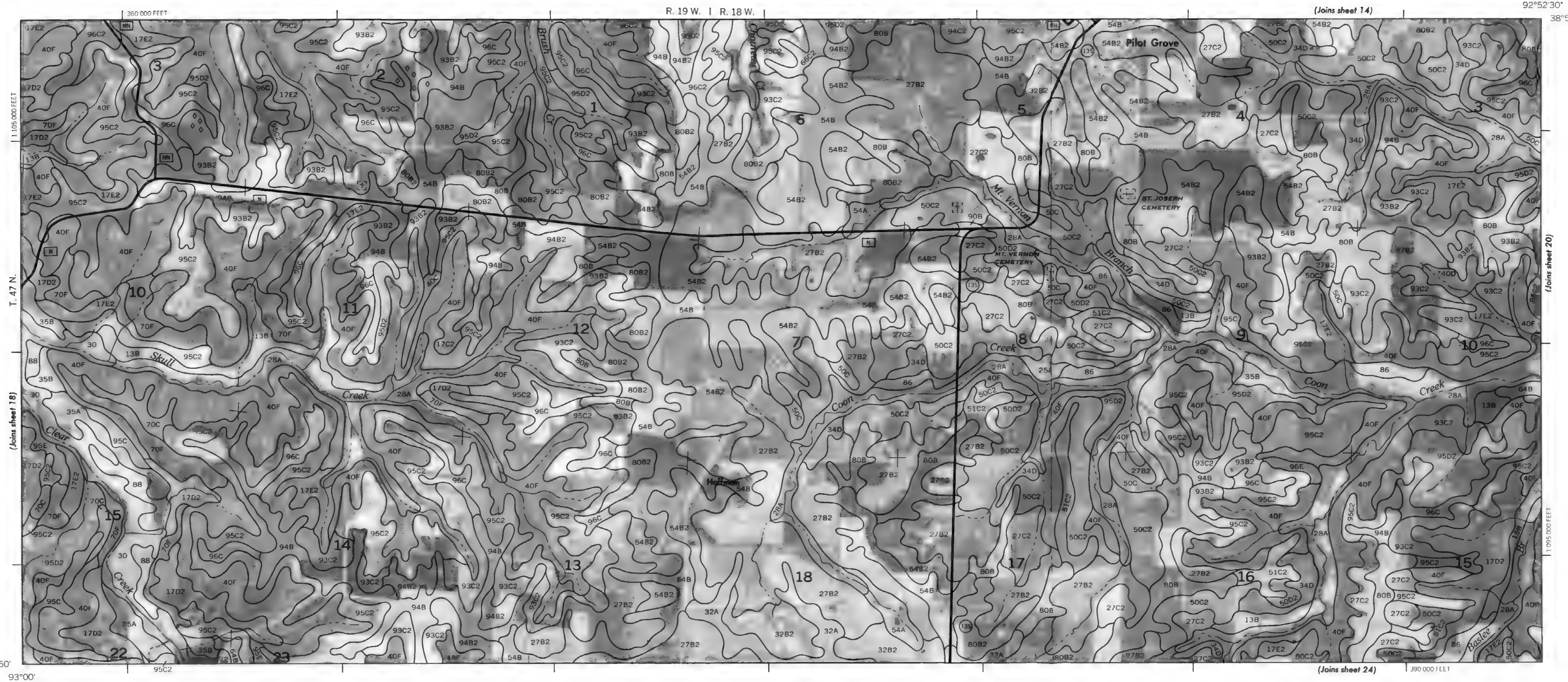
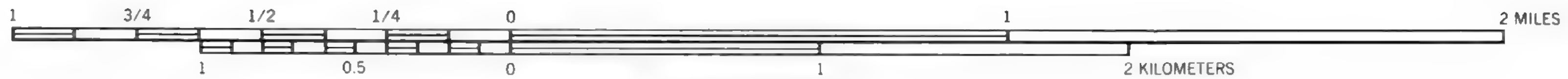
COOPER COUNTY, MISSOURI NO. 19



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000



SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 20

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21

N

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COOPER COUNTY, MISSOURI NO. 21

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 22

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 22

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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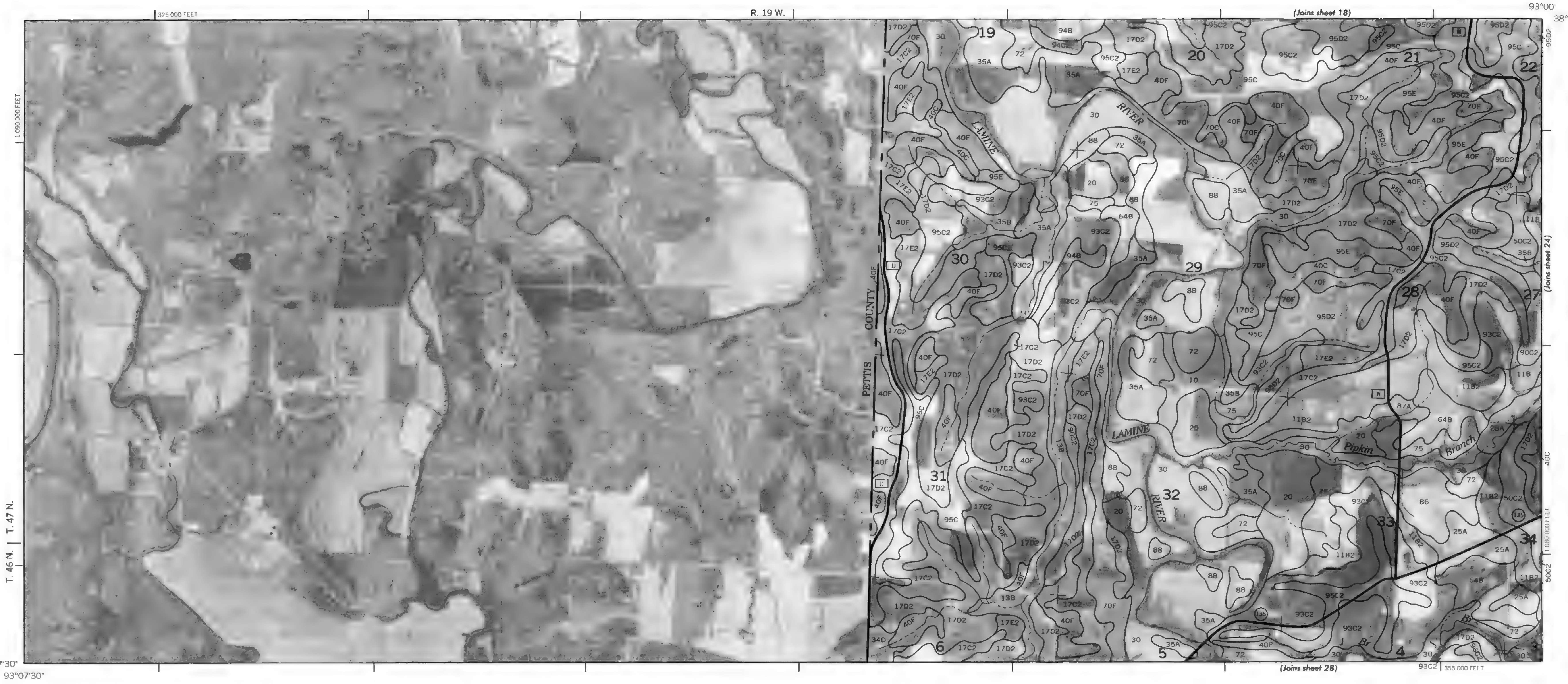
COOPER COUNTY, MISSOURI NO. 23

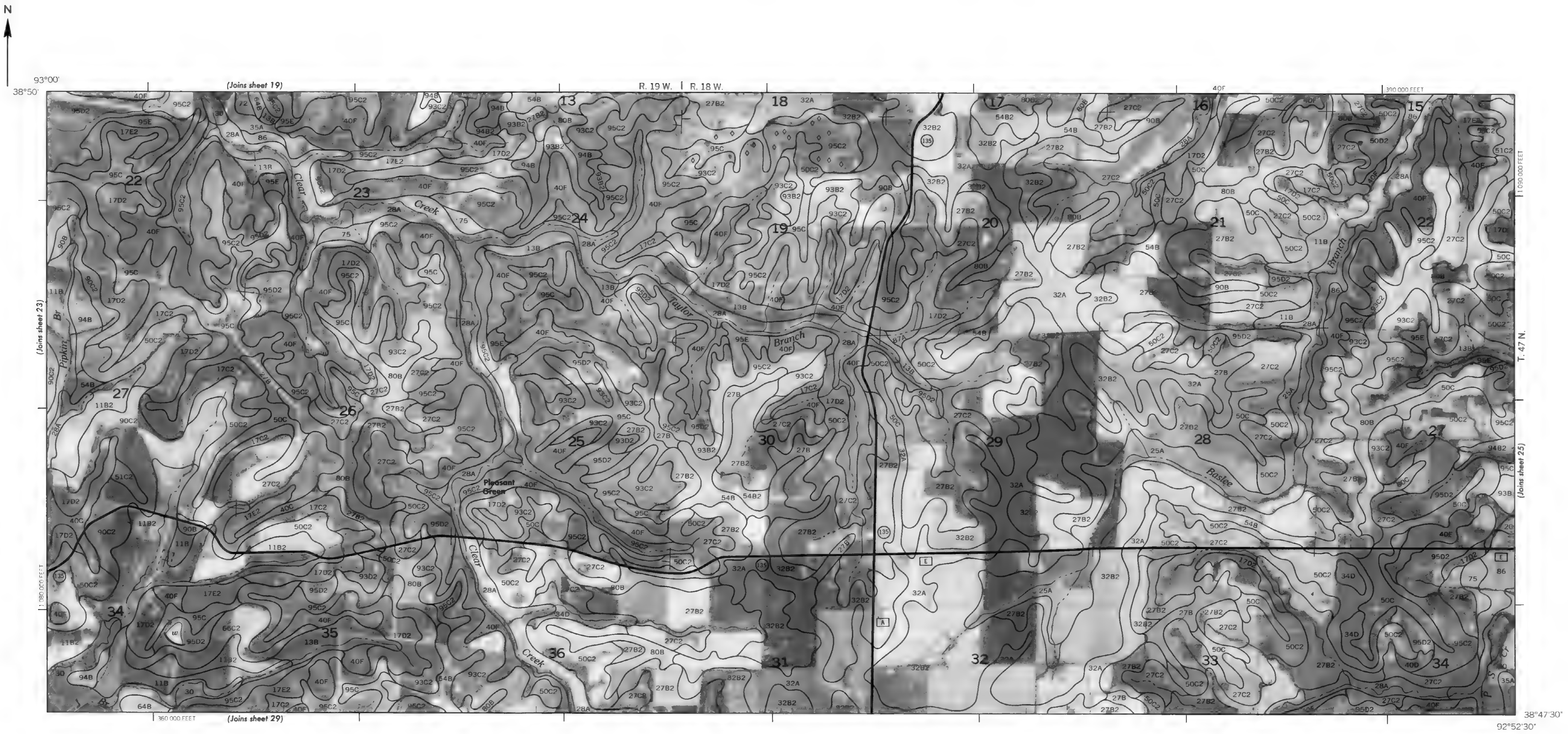


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 24



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 24

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COOPER COUNTY, MISSOURI NO. 25

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

26

N

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 26

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

27

N

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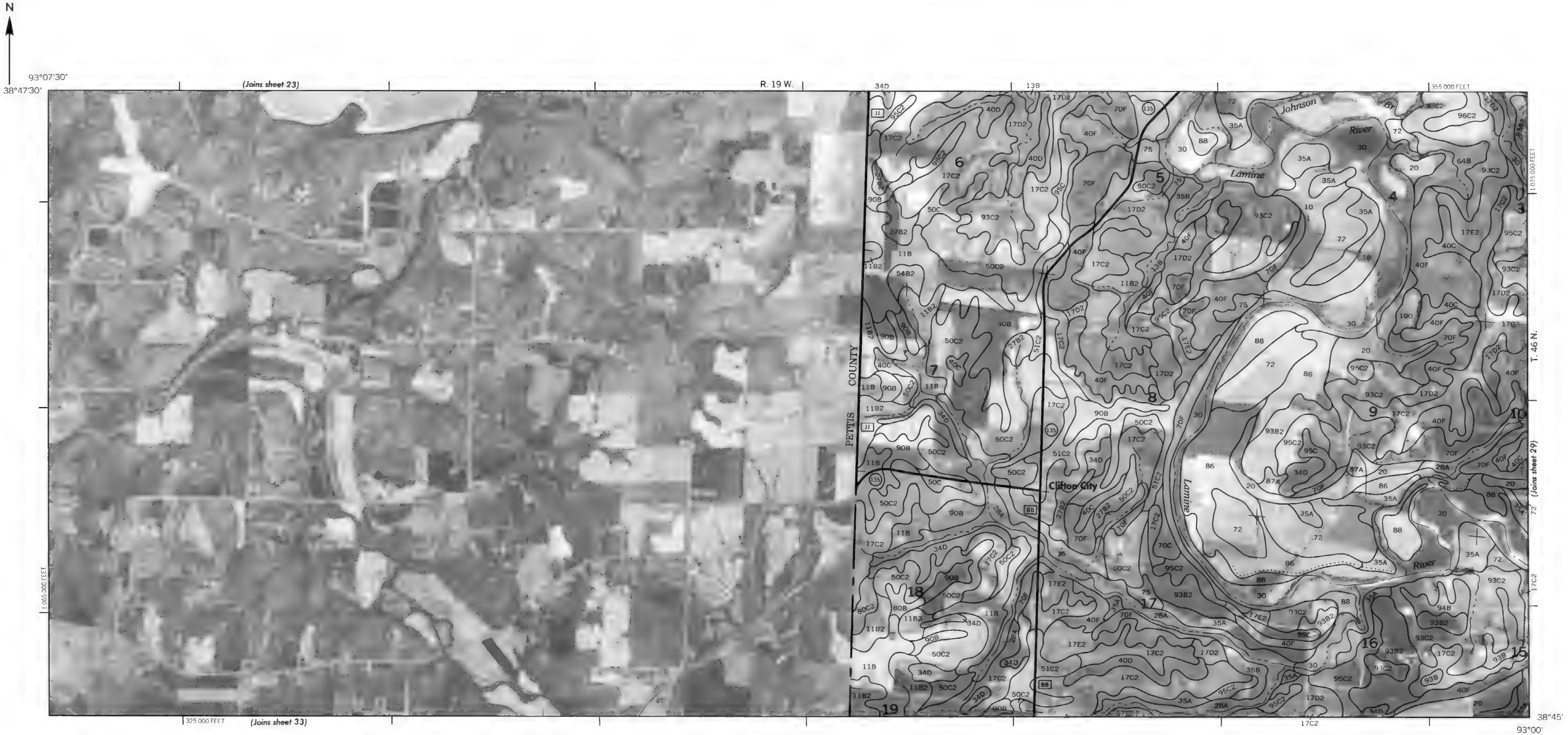
COOPER COUNTY, MISSOURI NO. 27

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 28



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 28

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

29

N

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

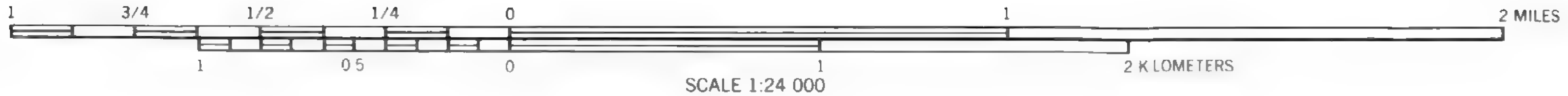
COOPER COUNTY, MISSOURI NO. 29

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 30



COOPER COUNTY, MISSOURI NO. 30

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

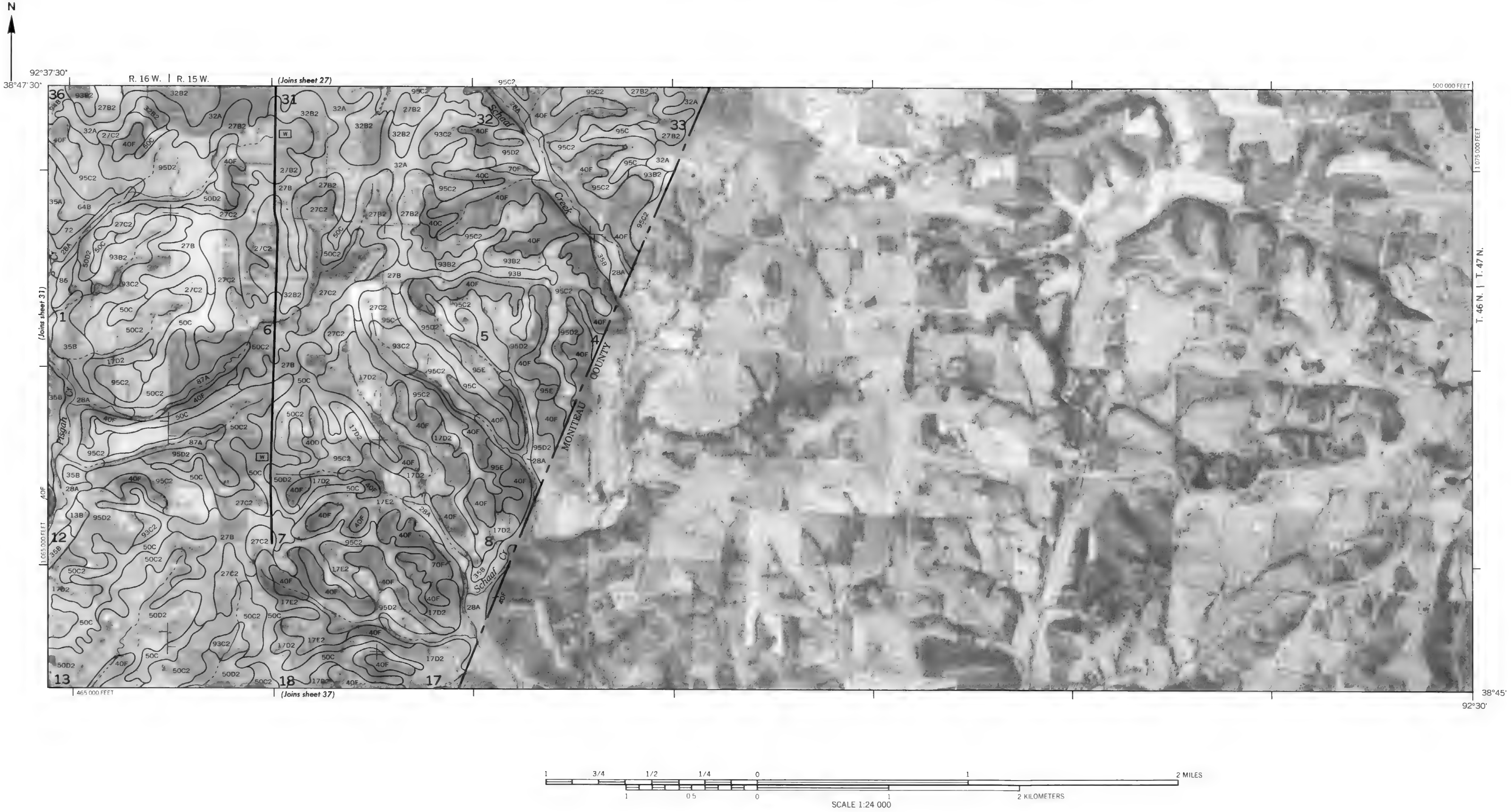
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 31



COOPER COUNTY, MISSOURI NO. 32

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

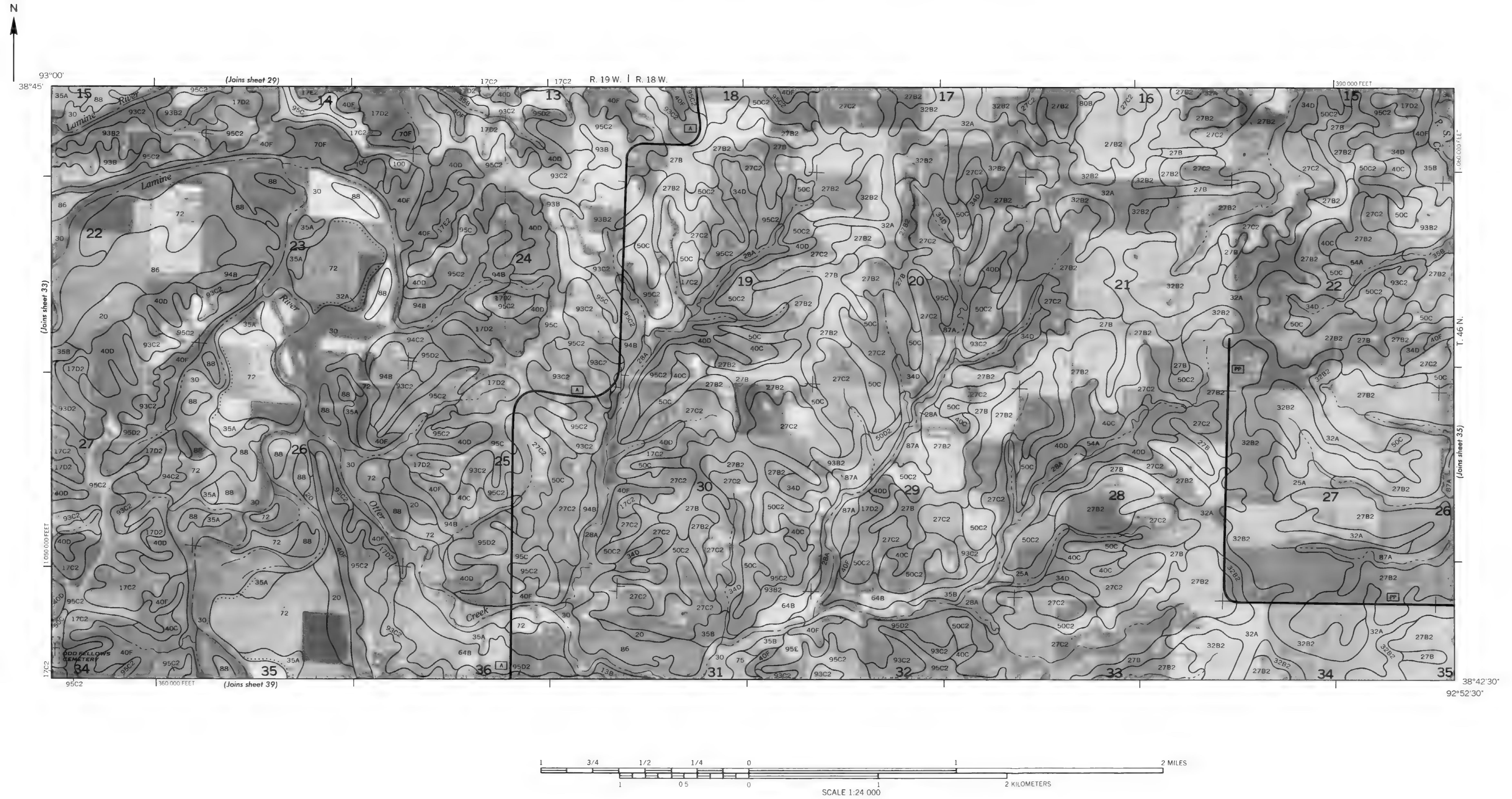
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 33



COOPER COUNTY, MISSOURI NO. 34

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

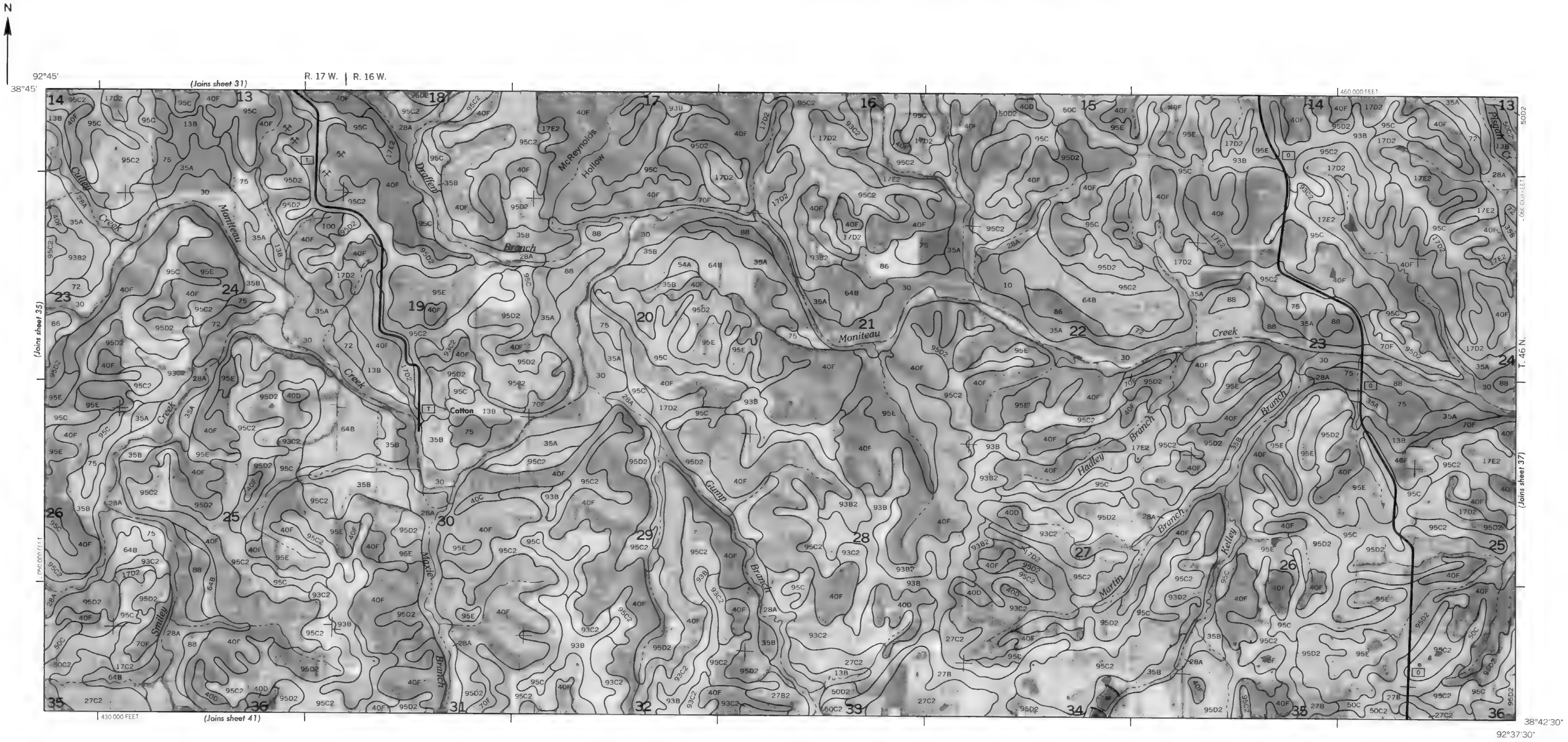
COOPER COUNTY, MISSOURI NO. 35

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 36



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

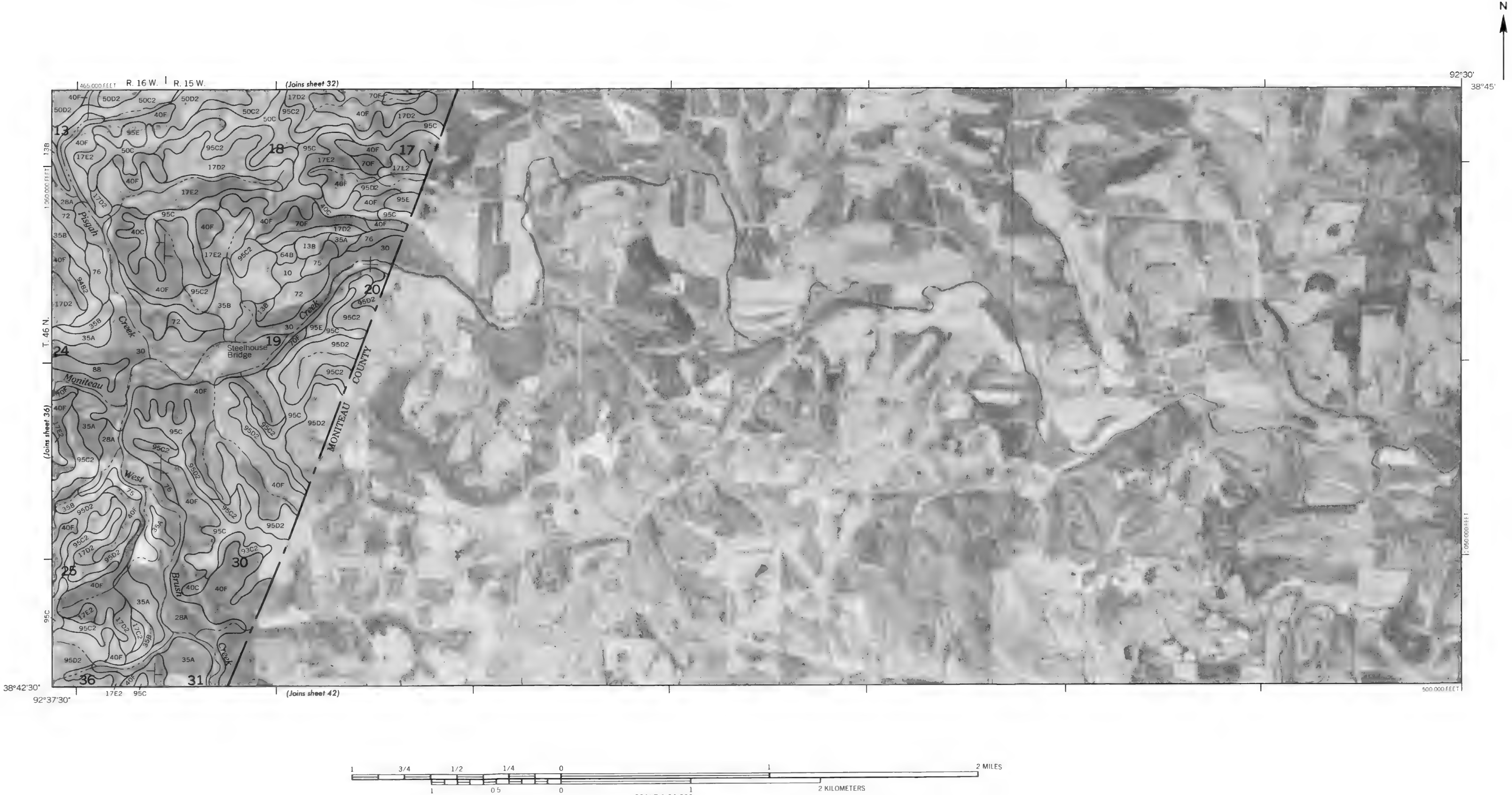
SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 36

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

COOPER COUNTY, MISSOURI NO. 37



SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 38

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(39)

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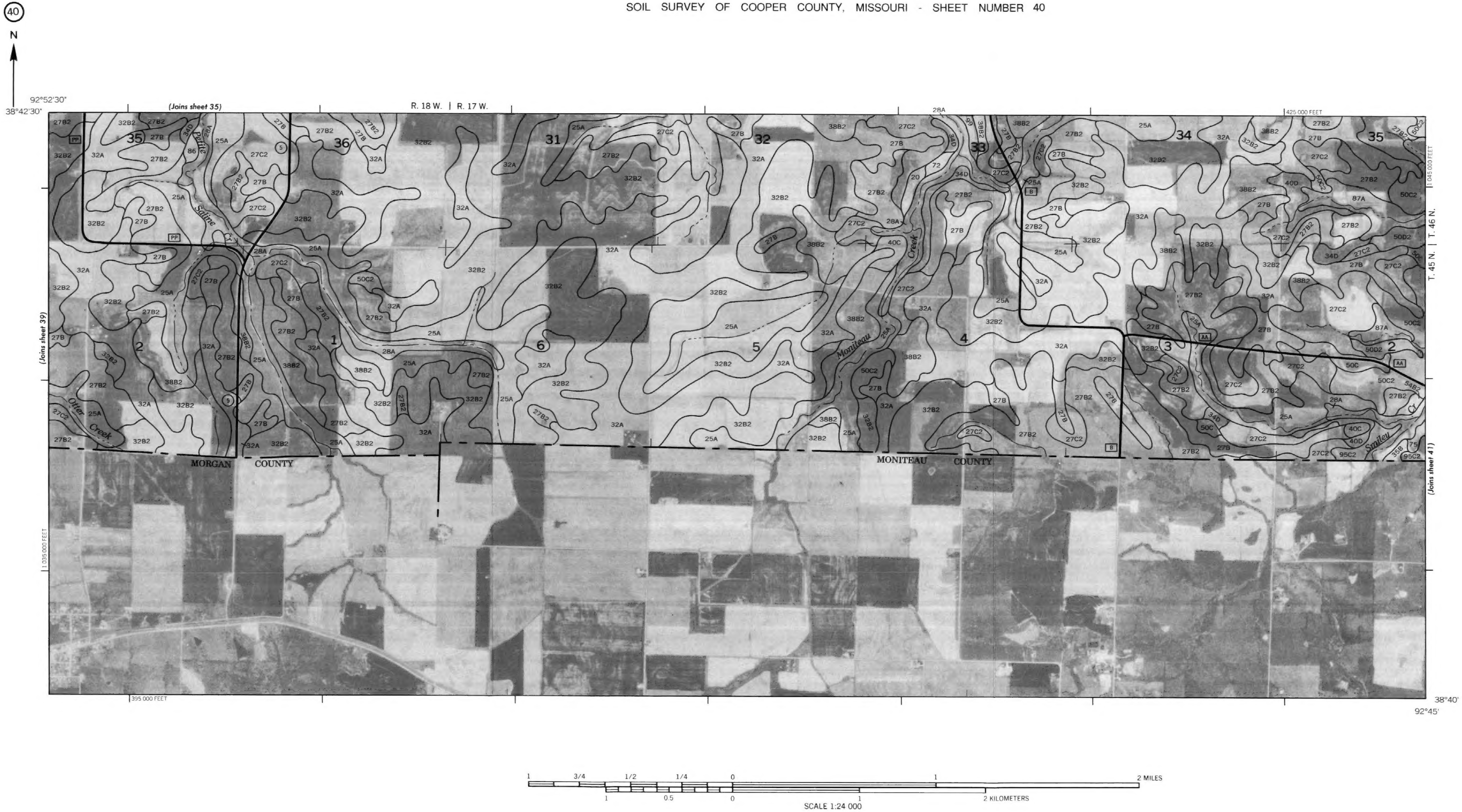
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 39

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000



COOPER COUNTY, MISSOURI NO. 40

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(41)

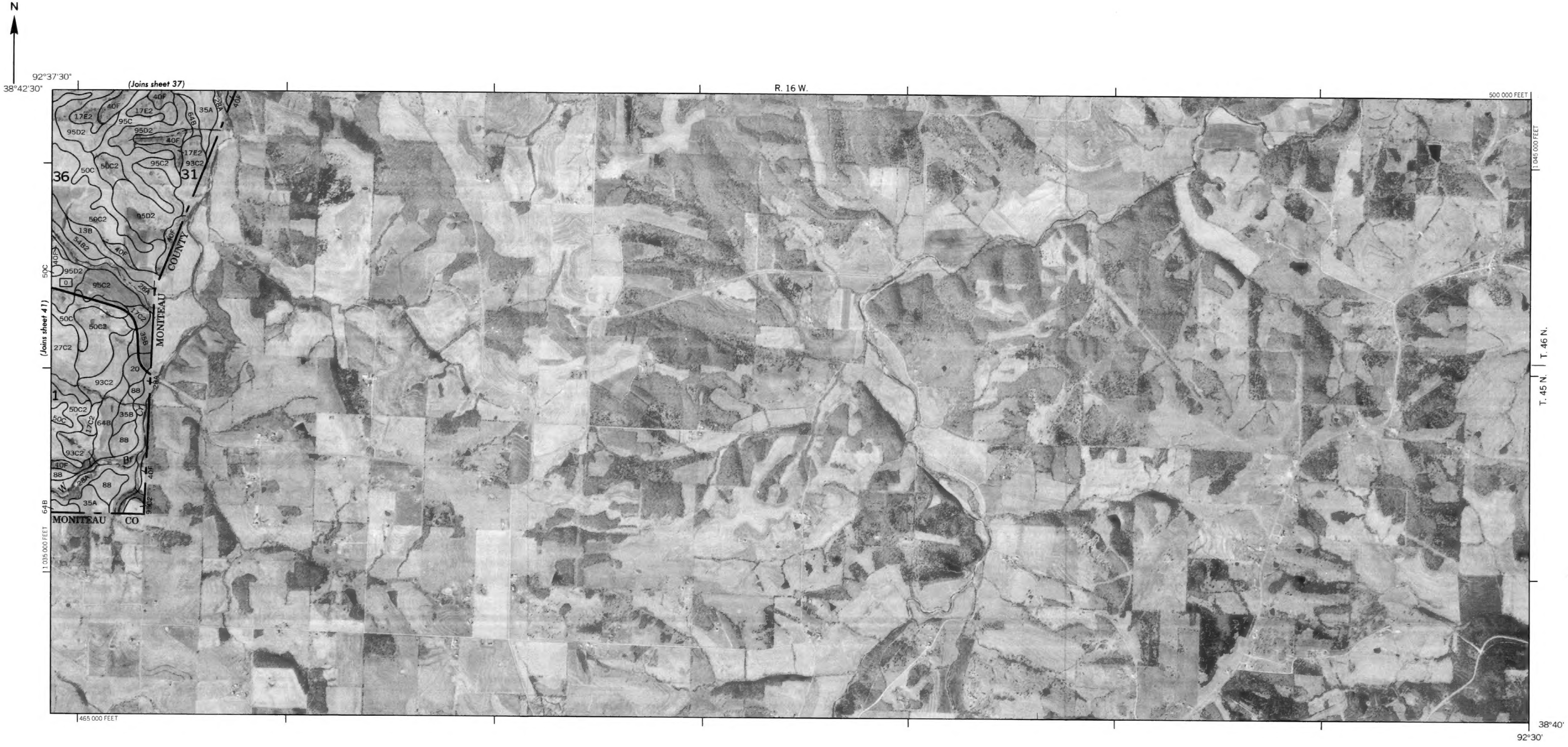
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

COOPER COUNTY, MISSOURI NO. 41

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

42

SOIL SURVEY OF COOPER COUNTY, MISSOURI - SHEET NUMBER 42



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

COOPER COUNTY, MISSOURI NO. 42

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.